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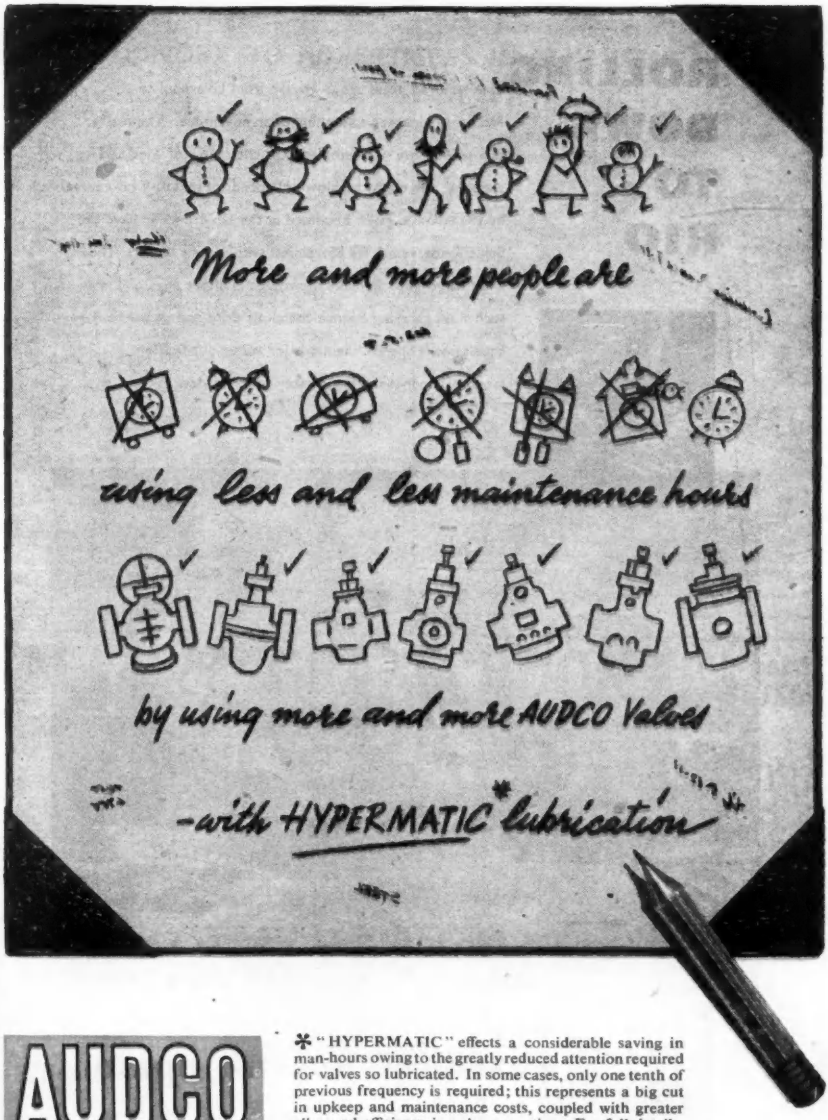
The Chemical Age

OL LXVI 5 APRIL 1952 No 1708



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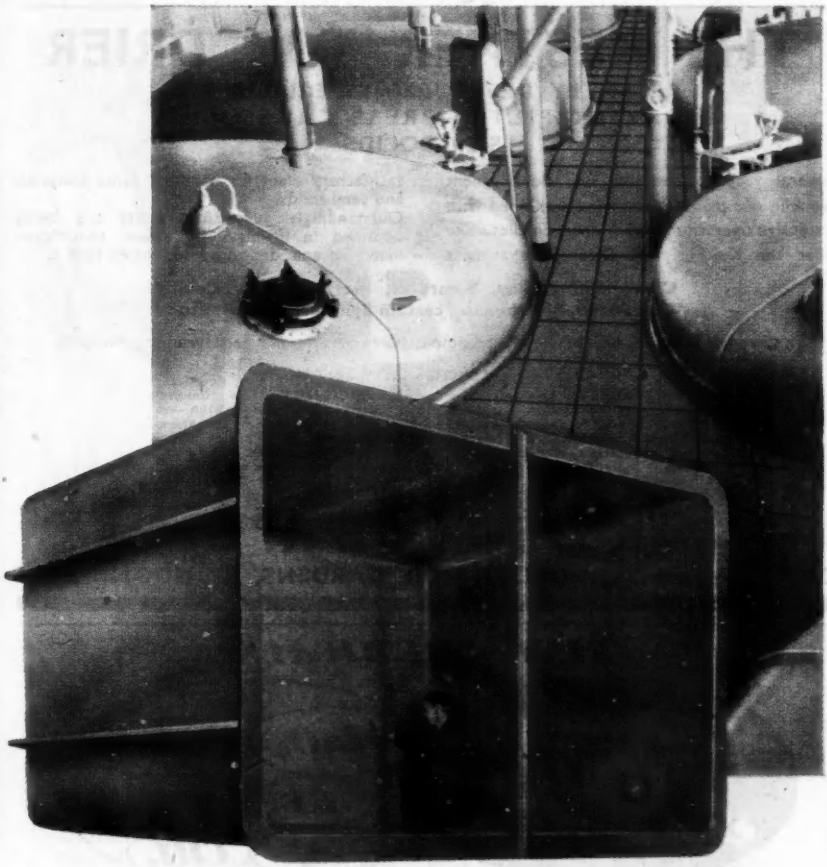
INDEX TO ADVERTISERS IN THIS ISSUE



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The
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The Captain of All . . .

TUBERCULOSIS, or consumption, was long ago named 'the captain of all men of Death' by John Bunyan, and although in many countries (including Britain) tuberculosis mortality has been steadily falling since about 1860, the disease here 'is still the main cause of death among men and women of working age' (Report of Medical Research Council, 1948-50). Similarly, in the United States it is still the most important single cause of death for the 15-35 age-group. It would be pleasant to suppose that the general decline in T.B. mortality was the direct result of scientific attacks upon the disease but there is no proof for this. The decline began in the 1860-70 decade, even before the famous work of Koch in isolating the tubercle bacillus, and certainly before such measures as early diagnosis, segregation at sanatoria, lung surgery, and vaccine or drug treatments were in use. Some attribute the decline to better sanitation in cities; others to better standards and variety of diet; others still to natural evolution. It is to be hoped that the second explanation is not too valid for, if so, the world may yet see tuberculosis regaining the grim rank given to it by Bunyan.

Nevertheless, it is not enough to accept a natural recession in the menace of T.B. It still remains the chief cause of death for younger generations. Many medical men believe that our intensified measures to eliminate bovine T.B. and to pasteurise all but tuberculin-tested milk will eventually remove a principal source of infection. It is a blot on our record in public health measures that we have followed other countries rather than taken a lead in this development. But even if this eventually reduces the incidence of T.B., it cannot help in the battle with established T.B. Prevention is the supreme and long-term aim; meanwhile, remedy and cure are equally important.

This century has seen notable advances in T.B. treatment. In recent years great hopes have been raised by chemotherapy. With other major diseases that are caused by bacilli succumbing almost spectacularly to new chemical drugs and antibiotics, it does not seem too much to hope for a substance that can conquer the virulent tubercle bacillus. Penicillin has failed but streptomycin at first seemed likely to reduce the bacilli to unconditional surrender. Unfortunately, as with other uses of this antibiotic, the susceptible bacilli soon develop resistance to it. Streptomycin alone offers little chance of cure; though it is a helpful 'prop' while the patient receives or is prepared for other treatment. It was

found, however, that streptomycin and *p*-aminosalicylic acid (PAS) together, appreciably reduced the capacity of the bacilli to develop resistance to streptomycin. At present this chemical-plus-antibiotic treatment represents man's peak effort, but such is the rate of progress that this still quite recent advance may soon be relegated to the past.

In the Medical Research Council Report already mentioned, it was stated that 'great interest had been aroused by a series of synthetic drugs—the thiosemicarbazones—developed in Germany, but animal work in this country, as well as clinical investigation in the U.S., has suggested that the benefit from their use may be more than offset by their toxicity. Laboratory work . . . has so far failed to produce less toxic and at the same time more effective drugs in this series . . .' Lately the American Press has carried some fairly sensational stories that new drugs of this desired kind have in fact arrived. Two chemical drug companies, after testing hundreds of semi-thiocarbazones, have independently but simultaneously reached the conclusion that isonicotinyl hydrazide can kill tubercle bacilli without being dangerously toxic. Isopropyl and glucosyl derivatives are also announced.

It is not clear how these substances kill the bacilli, though it has been suggested that they replace niacin, an essential nutrient for the bacilli, because they are structurally similar to niacin. When ingested, however, they kill rather than feed the bacilli. The results of clinical tests on animals and humans have shown great promise; patients who could no longer obtain relief from Streptomycin-PAS treatment gained marked benefit from the new drugs. The doctors concerned in these initial tests have reported that 'the mortally ill patients we have studied have obtained therapeutic benefit beyond anything we have ever seen with any of the chemotherapeutic or antibiotic agents previously utilised by us.' (*Chemical Week*, 1952, **70**, 10, 22.)

Optimism about this new development must, however, be considerably tempered. Medical research workers have already criticised the early release of information, and it now appears that the ordinary Press has forestalled even technical publication of this advance. No investigations with these drugs have yet been made by the U.S. Public Health Service or by the military medical services. From two to five years' further research, particularly controlled clinical trial, will be required to establish or disprove the claims that have been made in newspaper headlines. But whether or not there has been an unfortunate leakage of news, the fact is clear enough that a new prospect of chemical attack upon T.B. has been opened. That the new drugs have emerged from a previously hopeful line of investigation gives added encouragement to those who like to blend their scientific prudence with optimism rather than pessimism.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Future for Germanium?

GERMANIUM, one of the missing elements Mendeleeff predicted in 1871 and discovered by a German chemist in 1886, has not so far become a particularly useful metal. Some excellent alloys have been developed with silver, copper, aluminium and magnesium but a demand for these has never been appreciably established. But the future of the element itself is rapidly brightening—indeed, it may become one of the key-materials in electronic equipment. There are possibilities that the radio or electronic valve may be displaced in many of its uses by a modern form of the old 'cats'-whisker' crystal. The crystalline material will be metallic germanium. A valve can be replaced by a triode, which is a germanium crystal with two fixed and closely placed 'cats'-whisker' terminals and a third connection at the base of the crystal. The power consumption of triodes is much less than that of ordinary three-element valves. Also, a triode is far smaller. The size and running-costs of many electronic and electric appliances —including wireless-sets—will be reduced if germanium triodes fulfil their expectations. For some uses they are already accepted; for example, 20,000 triodes a month are being made in America for telephone switchboards. More research seems necessary to perfect the triode's performance in radio sets. A new demand for a scarce metal will undoubtedly arise. Much of the supply previously available has been by-production from zinc and cadmium extractive processes. The technology of germanium extraction may soon be well worth looking up, particularly as it is also rumoured that germanium crystal rectifiers are better for A.C.-D.C. conversion than selenium and copper oxide rectifiers.

Another Antibiotic

THE list of antibiotics in the literature is already long but the number that have achieved large-scale production and familiarity of name is still relatively small—penicillin, streptomycin, aureomycin, chloromycetin, and bacitracin. In February this year a new name qualified for the short list—neomycin, now in commercial production at Princeton, New Jersey. Neomycin emerged in 1949 from the research school of Waksman, and is said to have a wide range of anti-bacterial activity, particularly in dealing with bacterial infections of the skin, eyes, nose, throat, and the gastro-intestinal tract. It does not suffer from the serious weakness of streptomycin—the easy development of bacterial resistance. Little or no resistance is developed by the organisms that are sensitive to neomycin. Indeed, neomycin development has been partly aimed at closing the gaps created by streptomycin's limitations; whether these hopes can be realised remains to be seen. Neomycin has a very low toxicity to animals. The Heyden Chemical Corporation now producing neomycin is planning for export sales as well as the American market.

Purer Ponds

WHILE some scientists study the algae plants as a potential source of food, others study algae as a pest. Algae growth in lakes, ponds, or even in artificial baths and pools, has long been a nuisance and copper sulphate is the most commonly used 'algacide.' It is now reported that 2,3-dichloronaphaquinone will kill algae more effectively. Very small amounts are needed, much smaller than those quantities of copper sulphate now used. No deposits of toxic residues are left at the bottom of the lake or pool and it is said that the organic chemical is harmless to fish and other water-living organisms, but this point still requires further investigation. Like the development of 'Warfarin,' the new and successful rodenticide, this 'algacide' research was backed by the Wisconsin Alumni Research Foundation. A detailed account of the research, in which over 300 different chemicals were tested, will appear in July in the U.S. Journal, *Sewage and Industrial Wastes*.

The I. Chem. E.

Associate-Membership Examination

THE 28th Associate-Membership Examination of the Institution of Chemical Engineers will be held during the months of September 1952 (Sections C, D, E and F) and January, February and March 1953 (Sections A and B), the last date for receiving entries being 2 June, 1952. Entries must include completed form of application, Form 'A', and entrance fee of £7 7s.

First part of the examination (papers C, D, E and F) will be held in London and other centres, as found necessary, on Thursday and Friday, 11-12 September, 1952. Three hours will be allowed for each of the first three papers (C, D and E) which will be set on the 'Outline of Subjects Special to the Training of a Chemical Engineer,' as shown in the notes 'Hints to Candidates,' issued by the Board of Examiners. Approximately eight questions will be given in each paper, to only four of which the candidate is required to submit answers.

Scale Drawing Test

For the remaining paper (F), four hours will be allowed. This will consist of a scale drawing test for which candidates must supply their own drawing instruments. Instructions with regard to drawing boards and T-squares will be issued later.

Reference books as follows may be allowed for Sections C and D: 'Handbook of Chemistry and Physics,' Hodgman; Low's 'Pocket Book for Mechanical Engineers'; 'Steam Tables,' Keenan and Keyes; 'Tables of Physical and Chemical Constants, and Some Mathematical Functions,' Kaye and Laby.

Home Papers (Sections A and B) comprise eight questions in two parts, four relating to detailed design, and four to the commercial exploitation of processes, together with questions of a more general nature.

Candidates are required to answer only one question from each part. The whole of the work must be done by the candidate without assistance from anyone in any way, and a declaration to that effect must be made by the candidate, who is, however, expected to make the fullest use of books of reference and of other publications.

Papers will be posted to candidates on or about 1 January, 1953. Answers must reach the institution by 31 March, 1953, in the case of candidates resident in the British Isles.

The William Macnab Medal is awarded by the council to the candidate submitting the best set of answers to the full examination provided that a sufficiently high standard is attained.

Successful candidates will not be charged entrance fee on being admitted to the institution following the examination.

'Alcan's' Production Plans

New Project in British Columbia

FURTHER details have now come to hand concerning the vast project for the production of aluminium in British Columbia, which was reported recently. The project is sponsored by the Aluminium Company of Canada, and under arrangements made with the provincial Government of British Columbia it has undertaken to spend £57,142,857 on developing a vast amount of hydro-electric energy and producing a huge annual output of aluminium in a mountainous area 160 miles long by 60 miles wide lying some four hundred miles north of Vancouver.

The company will construct on the Nechako River the biggest dam of its type in the British Commonwealth to back up 150 miles of water. This water will be diverted by two tunnels bored for ten miles through the granite of Mount Portal in the Coastal Range. At their western outlet at Kemano a large power house is being built and from it the power will be conveyed some fifty miles by transmission lines to Kitimat on an inlet of the Pacific Ocean, where a smelter will be erected to produce aluminium products from bauxite brought by sea from British Guiana.

At present 'Alcan' is spending roughly a million dollars (£357,000) a week on construction work of different kinds and good headway is being made with it. The initial production is to be 420,000 horse-power and 83,000 metric tons of aluminium a year. The original plants are to be in operation by 1954. The output of aluminium will be gradually raised to 180,000 tons a year, and if the state of the international market for aluminium justifies it, perhaps to 500,000 tons.

Plant Manufacturers' Annual Meeting

Dr. W. D. Scott Principal Guest

AT the 32nd annual general meeting of the British Chemical Plant Manufacturers' Association held at the Trocadero Restaurant, London, on Thursday, 27 March, Mr. H. V. Yorke of Bennett, Sons & Shears, Ltd., was elected chairman for 1952 in succession to Major V. F. Gloag, M.C. Messrs. E. S. Franklin (Torrance & Sons, Ltd.), G. N. Hodson (Earthenware Ltd.) and R. F. Stewart (Dorr-Oliver Co., Ltd.) were elected vice-chairmen and Mr. P. W. Seligman of The A.P.V. Co., Ltd., was elected hon. treasurer.

In presenting its report for the year ended 31 December, 1951, the Executive announced that 19 firms had joined the BCPMA during the year and that there had only been three resignations. The Association now had 150 full members and 32 associate members and during the past three years membership had increased by 82 per cent.

World shortages of raw materials and the increasing tempo of defence production had made the year one of increasing difficulty. Steel of all types had become scarce and stainless steel critically so. As a result, production programmes were thrown out of balance and many partly completed jobs were held up for small quantities of material or through delay in delivery of components.

Importance Emphasised

The Association had given close attention to these problems during the year and had taken every opportunity to emphasise the importance of the chemical engineering industry. Efforts had been made to impress upon the Ministry of Supply that stainless steel was essential to the manufacture of a wide range of chemical plant and this point had been accepted by the Ministry. It was too early for it to be seen what members' allocations would be and members were urged to make all possible economies in its use and exchange ideas on how scarce materials could be saved. A number of reports and memoranda had been sent to members on the subject of saving those materials which were in short supply. The Association had co-operated with various technical committees and there had been improved co-operation between the chemical manufacturers and the plant manufacturer. In a notable instance it was found possible by using alternative materials to reduce the amount of stainless steel required for a complete process plant from 400 to 100 tons. The hope was expressed that the chemical manufacturers would help both the plant suppliers and themselves by not insisting on specifications involving alloy steels in cases where alternative materials were adequate for the duty involved. The Association would gladly consider any ways of economising in scarce materials that users might care to suggest.

Rôle in Export Drive

Referring to the rôle played by the chemical plant industry in the export drive, the report stated that the Government is apparently looking to a further increase in exports in 1952. The Association had found that the Government was not able to give the kind of assistance with regard to priority of exports that was necessary. Had stainless steel been readily available, members could have obtained considerable business from Canada and the United States during the year. Many of the American inquiries called for large tonnages of stainless steel in a comparative simple fabricated form and were known to be prompted by the shortage in the U.S.A.; and members could not be encouraged to pursue them. In Canada, however, the inquiries resulted from members' determined efforts and presented a valuable opportunity of securing a share of the market created by the expansion of the Canadian chemical industry. It was, stated the report, most discouraging to see this opportunity lost for the want of raw materials.

Following the meeting the Association held its annual luncheon, presided over by the retiring chairman, Major Gloag. In proposing the health of the guests, Major Gloag said for the second year in succession it was his pleasure to welcome their friends to the luncheon. Before introducing the principal guest, Dr. W. D. Scott, deputy managing director of Monsanto Chemicals Limited, he welcomed representatives from the various Government departments and

from other trade and professional associations and expressed his appreciation to the members of the Association's staff.

Dr. Scott spoke, in part, as follows:—

The value of capital assets directly associated with chemical activity is difficult to determine but it cannot be less than £500,000,000. The 1951 capital expenditure by the chemical and allied industries has recently been quoted as £56,000,000, which means that we are absorbing 12-15 per cent of the total new capital now being created by manufacturing enterprises. This could be regarded as encouraging, for the corresponding figure for the U.S.A. is 8-9 per cent. But remember that in the chemical industry we have a long way to catch up.

Expenditure Excessive

It does not need Government admonitions to tell us that the nation's rate of capital expenditure is too great for the country to afford at the present time. The facts and figures speak for themselves. Figures for the last four years reveal that whereas from 1948-1950 we were financing capital formation exclusive of Government capital expenditure to the extent of 60-75 per cent from profits and reserves, the figure for 1951 is only 24 per cent. The difference is to be found in tax reserves. You will be interested in the corresponding figures from the U.S.A. where 80-85 per cent of industrial financing can still be undertaken from profits and reserves though in the rapidly expanding chemical industry hit by the incidence of excess profits taxes, the figure for the next few years will be nearer 60 per cent.

Many of our products are required as raw materials for the manufacture of positive defence items, while in the manufacture of munitions our industry plays a leading part. Nevertheless, I would like to point out that in 1939 few chemical works in this country found they were manufacturing products which were not required both urgently and in greatly increased quantities. The industry is both basic and resourceful, being by its very nature very adaptable to change. So I would ask our Ministerial friends not to worry because some part of our products end as unessential or luxury items at the present time; if the worst happened, the production facilities would be of tremendous value whereas most of the direct defence requirements, however necessary to-day, are valueless as long-term national assets.

We readily accept a policy that all available manufactured goods must be exported even to the detriment of capital projects already in course of construction, but we would join our plea with other industries that if the policy is not changed at the earliest possible opportunity the consequences could be most unfortunate.

The chemical plant industry has always played a prominent part in the export drive, but, as stated in your Annual Report, your export achievements must be limited by the prior claims of the home chemical manufacturers whose contribution to the national economy and the defence programme is vital. The Ministry concerned still accepts as valid the argument that while the chemical plant manufacturers should be encouraged to increase their exports, in view of the claims of the home chemical industry, no target should be set. This is most encouraging and we trust that it is a policy which will be fully implemented to the extent of allocating the appropriate raw materials to your industry.

Time costs money in capital and markets. We are able as an industry to compete in world markets with a large number of our products. In terms of world trade we are favourably placed with many basic raw materials. We can work out new processes and we can evaluate economic projects thereon. But, again and again, because of the time taken to design, to license, to fabricate and to erect plant, we find world events have overtaken us and the commercial and economic bases of our evaluations are proved to be false. Is it not a very disturbing thought that we take twice as long as Germans or Americans to complete a project? Is that the way to take full advantage of our opportunities? Where is the fault? Possibly it lies in part in bad communications, in part in lack of standardisation, in part in lack of appreciation of the size of the project, and in part in too many people asking for a share of the cake.

Stability Desirable

Time and again we hear the well-justified criticism that the chemical industry is forever changing its mind. But you as the supplier of our capital goods are justified in demanding some stability of requirement. So I would plead with our industry to make up their minds and freeze their process design so that the plant design can be

expeditiously executed. Our requirements do change rapidly and unless you can hasten the mechanical design and fabricating processes you are bound to get into trouble with an industry in which the technological advance in a period of three years may be very considerable.

A part of the chemical industry would certainly like to see a much greater rate of progress regarding standardisation and therefore has joined with certain elements of the petroleum industry to determine whether certain of their common interests could not be codified. We could envisage a tremendous saving in design, fabrication and construction time if the process design engineers could pick from the shelf functional items of equipment such as heat exchangers, pumps, enamelled vessels, valves and cocks, filters and centrifuges. In this respect the U.S.A. are far ahead of us and thereby have a very great advantage in time. I would therefore plead with you to proceed with the principle of standardisation as rapidly as possible.

The Importance of Research

Naturally, the chemical industry would hope that standardisation would lead to lower costs and therefore to lower prices. It could also lead to greater margins to be ploughed into creative techniques of fabrication. As an industry we would strongly urge you to become big enough to afford research. So we are delighted to read in your Annual Report that the conclusions of the Cremer Committee will be fully considered by your Council. But please remember that your problems cannot be entirely solved by a central chemical engineering research organisation. It is the use you make of new information communicated to you that matters. Opportunities for experimentation abound in the chemical industry despite our insistence on standardisation and, if we get standardisation where it is due, there is much more scope for the experimental approach. For the moment we ask you to do everything you can to save time. For the future we ask you to appreciate the great opportunities which await you. Maybe they can only be exploited by a greater degree of co-ordination among yourselves and with the chemical industry than exists at present.

There has been too great a demand on limited resources. Whether pooling of effort would extend those resources I do not know. But the problem exists. If you have lost time because of lack of materials we can suggest to our Ministerial friends that either there has been lack of recognition of the importance of our industry or your allocations are inadequate. In our demands on your facilities and products we compete with a powerful and all-consuming industry, but in terms of capital expenditure and product value we are still the more important.

Efficiency Vital

We cannot expect to export unless we are technically ahead of our competitors and are making a more efficient and economical use of resources. Indeed this factor is also, as far as the chemical industry is concerned, very much intermeshed with the saving of imports and relief of basic deficiencies.

Most of the commodities we utilise in manufacture are imported and we are faced with startling developments. Many basic commodities which affect this country's trading future are threatened by chemical developments which seemed to be merely of academic interest 15 years ago. We are confronted with commodity replacements in every direction and in our fight to preserve the commodity front we may well be losing our commercial position to the U.S.A. The position of natural rubber is already precarious. The price structure of wool is threatened by synthetic substitutes. Many substitute plastic materials now exist for natural hides and skins. Plastic tubing has replaced copper. Vegetable oils are not the dollar earners that they were. I do not suggest that it would be a wise policy for us to spend capital blindly on projects for these substitute materials at the present time. If we did we would just be putting out of business our own kith and kin and at the same time we would lose some very valuable export markets. Nevertheless, sentiment for past commercial traditions must not be allowed to block natural economic trends. It would seem wise therefore for every incentive to be given to the chemical industry to keep the nation in the front of technological developments.

The world shortage of certain minerals is also of the utmost importance to us. It is probably propitious and certainly of interest to your Association to make reference to the development and utilisation of stainless steel

within the chemical industry. Your Association has taken every opportunity to make it clear to the Ministry that stainless steel is essential to the manufacture of a wide range of chemical plant. By the use and development of this material the chemical industry has already saved many thousands of tons of both steel and that new rare metal —lead. It is, I suggest, just foolish to believe that the chemical industry can do without alloy steel, though it is equally foolish for the chemical industry to press its demands solely for the sake of a gold-plated job which will last for ever. On the other hand, I know of one plant which is in a state of dissolution, well out to sea, as a result of foolishly submitting to pressure to use steel of unsuitable properties.

Finally, I would like to refer to efficiency in use of labour resources. Recent figures have demonstrated the high capital investment per unit of labour in the chemical industry. But, judged by the performance of the petroleum industry to which we are a bad second, there is much room for improvement. By the very nature of many of our processes it is possible and desirable to eliminate manual operation. The chemical process is a communication of information in such a form that control is readily applied.

It is associations such as your own and our own which through their lateral lines of communication with their members and associated associations, can help to bring to the notice of the nation the importance of our industries to the national welfare.

N-Methyl Acetamide

Interesting Work by Dr. M. A. Phillips

RECENTLY M. A. Phillips, D.Sc., F.R.I.C., principal of the well-known London consulting chemists and chemical engineers, had occasion to examine a few ampoules of a viscous material stated to be a solution of a barbiturate in a neutral solvent. These ampoules were obtained by an associate on a recent visit to Germany and they were examined as a matter of general interest.

It was not difficult to identify the barbiturate as phenobarbitone but the solvent gave some difficulty and, as a matter of fact, Dr. Phillips and his associates are not yet able to state what it is with certainty.

However, a search of the literature revealed the existence of a patent on the solution of barbiturates in N-methyl acetamide, and it was found possible to obtain a very similar viscous solution with practically identical physical properties by dissolving 20 g. of phenobarbitone by gentle warming in a 90 per cent aqueous solution of N-methyl acetamide. Hexobarbitone is not soluble in this solvent to any extent sufficient to make the solution biologically interesting.

Dr. Phillips' Method

The N-methyl acetamide was prepared by the following method:

Stage I.— Methylamine hydrochloride. Methylamine solution (20 per cent aqueous) free from ammonia was neutralised, with cooling, stirring, and using a CIE pan in a cooling bath, with concentrated hydrochloric acid B.P. The mixture was then evaporated to dryness on a steam bath. The yield was theoretical and the m.p. of the product was 224°. The product should melt completely at this temperature;

Stage II.—N-methyl acetamide. Methylamine hydrochloride (3 Kg.) was mixed well with acetamide (3 Kg.) in a 50 l. glass flask (r.b.) using an air condenser of 5 ft. length and 1½ in. diam. The mixture was air-heated to melting. There was a vigorous reaction which was easily controllable by removing the source of heat, and ammonium chloride separated while the mixture was still hot. When the reaction was over (10 minutes or so), the mass was allowed to cool to about 40°C. and chloroform (about 5 l.) was added to enable the mixture to be filtered.

The mixture was then filtered, using a vacuum, and the ammonium chloride washed twice with small amounts of chloroform. The solvent was distilled off and the residue allowed to crystallise completely. The yield was 3.82 Kg. (90 per cent of the theoretical amount) and the product melted at 202-210°. It was rather hygroscopic and had to be used at once or stored in a dry container, well stoppered. (Compare Galad and Elim. *J. Amer. Chem. Soc.* (1943) **65**, 1567.) N-methyl acetamide (900 g.) was diluted with distilled water (100 ml.), and a viscous solution was formed. For this operation some gentle heating is sometimes necessary to obtain complete mixing and a stirrer is advisable.

Production of Chloromycetin in U.S.A.

New Equipment & Materials Required

COMPLETION of the first modern chemical plant completely designed and built for the synthetic production of an antibiotic can be regarded as a definite step forward in scientific progress.

The new plant has been built on the shore of Lake Macatawa in Holland, Michigan, U.S.A., by Parke, Davis & Co. for the manufacture of chloromycetin.

When chloromycetin is made naturally by means of fermentation, only one isomer, the biologically active one, is formed. However, when produced by synthetic chemical means, four isomers result, three of which are inactive. These are separated by methods based on their solubilities.

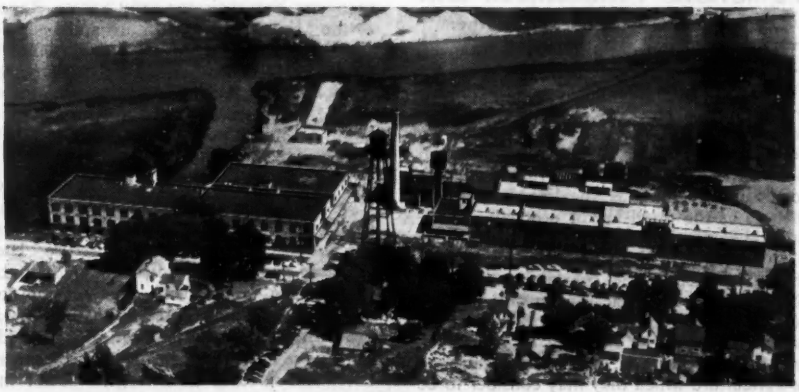
Complete synthesis involves three condensations, three hydrolyses, two acetylations, one reduction, and one optical resolution.

Many of these reactions are unusual and have seldom been operated before on the scale projected for this new plant. A number of different types of equipment and materials of construction were therefore made necessary. Thus, five different types of filters for liquid-solid separations were built, four different types of dryers for solvent removal were constructed, and unusual mixers for high-capacity agitation were built of special designs and utilising many types of corrosion-resistant materials.

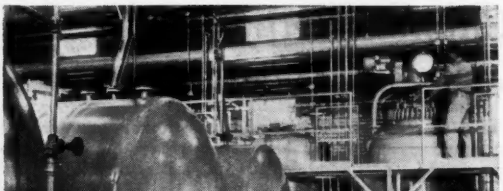
Of particular interest is the distillation equipment which was specially designed and built for the continuous recovery of solvents. These units are of the most advanced design and are engineered for the continuous recovery of organic solvents which are discharged from the process as both binary and ternary compositions. All of this equipment is set up with automatic measuring devices and controls and is built of stainless alloy constructions to combat the corrosion problems involved.

To handle the storage of organic solvents, a segregated tank farm has been constructed with a capacity of over 100,000 gallons. The tanks in this area are safeguarded by the most modern protective devices and are buried in the interest of the protection of life and property. Automatic controls meter these solvents to the various processes as required for operations.

Disposal of the large volume of liquid wastes generated by these chemical processes was a particularly acute problem because of



The new Chloromycetin plant built by Parke, Davis & Co., at Holland, Michigan, which when completed will more than double the firm's capacity to manufacture the antibiotic. Chloromycetin has been found effective against over 100 different diseases and pathogenic bacteria



Some of the storage tanks and vacuum stills which play an important part in the synthetic chemical production of chloromycetin at Holland, Michigan

the toxicity of the waste and the location of the plant in an area where fresh water is a very valuable natural resource. The problem was finally solved by drilling a well over 1,500 feet deep into a porous geological stratum below the surface of the fresh ground water levels. The disposable wastes are injected into this stratum by forcing them under high pressures down the well casing with the use of high capacity pumps.

The requirements for cold water supply for condensation equipment made necessary the installation of refrigeration units which are capable of producing low temperature mediums equivalent to the manufacture of 400,000 lb. of ice per day.

Also of interest is the fact that all of the processes are as completely instrumented as possible from the standpoint of design. In order to protect this instrumentation, even the air supply for the control equipment is passed through special drying units to reduce the water vapour content to extremely low figures.

Poisonous Substances Bill

Zuckerman Report Carried Further

THE Agriculture (Poisonous Substances) Bill, introduced on 25 March in the House of Lords and published on the following day, provides for the protection of workers against the risk of poisoning by certain substances used in agriculture. It would give the Agricultural Ministers power to make regulations dealing with such matters as the provision of protective clothing and equipment, washing facilities, periods of working, and the supervision and training of workers. The substances to which the Bill relates are the dinitro and organophosphorus compounds but the application of the Bill could be extended by the Ministers by Order to any other substances used in agriculture which they may consider to be dangerous to persons engaged in their use.

This measure carries a stage further the work of the Working Party on Precautionary Measures against Toxic Chemicals used in Agriculture, of which Professor S. Zuckerman was the chairman, and whose Report to the Minister of Agriculture and Fisheries was published by H.M. Stationery Office in April, 1951. The Working Party advocated that certain of its recommended precautions should become the subject of statutory regulation and the passing of the Bill would enable this to be done.

It is not in any case possible, however, for regulations to be in force for the earlier part of the 1952 spraying season. A voluntary precautions scheme has therefore been prepared and is being put to the agricultural organisations concerned. This scheme follows broadly that accepted by the industry in 1951, though some modifications and additions have been made in the light of experience and greater knowledge. Until this revised scheme for 1952 is published, users of the dinitro and organo-phosphorus compounds should follow the precautions recommended in 1951.

Tanning Processes & Materials

Results of DSIR Sample Survey of the Leather Industry

THE Research Associations, about forty in number, play a large part in bringing science to industry. This is no easy task, however, for each association has to maintain a balance of effort between its fundamental research, its information and day-to-day services, and its applied science. Every industry is sectionalised and each section has its own problems. It appeared to the Department of Scientific and Industrial Research that it would be worthwhile examining in some detail the correlation of research with economic needs, and that this could best be done through a sample survey. The Department therefore invited the co-operation of three Research Associations in reviewing their resources, facilities and programmes in relation to the scientific, technological and economic needs of their industries. The report of the Survey Panel of the British Leather Manufacturers' Research Association has just been released.*

Capital Locked Up

In all sections of the leather industry much capital is locked up in hides and skins in transit and being processed. A reduction in process time, particularly in heavy leather tanning, would allow a quicker turnover of capital, a reduction of overhead costs per unit of output, and a reduction in financial risk. Tanning materials and chemicals also represent a considerable item in which economies or alternatives are being sought.

In 1945, the Association published two reports (Supplementary Laboratory Reports, 1945, **55**, pp. 1 and 7) describing a modern quick tanning process, developed and tried out in practice, which reduced the total tanning process time from an average of about three months to something like six weeks. A few tanneries adopted the process to meet wartime requirements, many thousands of hides being successfully tanned. Since the war, however, they have reverted to traditional methods in order to satisfy their customers. It is the general experience of the heavy leather trade that the quality of the finished leather varies in proportion to the length of tanning time, and it has not been established that the new methods yield leather of as good quality as the more usual methods. Nevertheless, further investigation of new methods by tanning trials might be of value from both the technological and economic standpoints. Since leather is a fibrous material, it can be expected that such investigations would benefit from the greatly increased knowledge of the molecular structure and properties of artificial and natural fibres of all kinds.

Concern Expressed

Since the war concern has been expressed at the price and long-term supply position of natural tanning materials, and this has led to an increasing interest in alternative sources of supply and in synthetic alternatives. At present the United Kingdom requirements are about 50,000 tons per annum reckoned by tanning content, nearly all of which is imported or extracted from imported materials. In 1950, imported materials comprised 29,500 tons of mimosa, 5,900 tons of quebracho, 7,800 tons of myrabolana, and 5,200 tons of oak, chestnut and valonia. Since 1947, the percentage of mimosa has risen while that of quebracho has fallen sharply, though the combined total of these two materials has remained fairly steady. The main sources of world supply in former years, quebracho and chestnut, are dwindling owing to exhaustion of the forests and disease, so that at present rates of consumption a serious world shortage is anticipated in 10 or 15 years' time.

The Imports Substitutes Panel of the Committee on Industrial Productivity, which reviewed the position in 1949, recommended either a considerable extension of the mimosa acreage in South and East Africa, or a greater effort to find alternative tanning materials using mineral and synthetic agents as well as natural materials. It is possible, however, that if prices of vegetable tannins rise further, more abundant supplies of natural products will arise through either the more economical working of old supplies, the cultivation of plants at present harvested in the

* The Work of the British Leather Manufacturers Research Association for the Leather Industry. Obtainable from the B.L.M.R.A., Milton Park, Egham, Surrey, or through any bookseller. Price 5s., post paid 5s 3d. ($1.25 U.S.A.).

wild state, or the use of new vegetable sources.

A review of current activity in 1949 by DSIR, following the recommendations of the Committee on Industrial Productivity, produced some interesting information. The main use of vegetable tans is in producing heavy leather, whereas the main use of syntans has been found for light leather, especially for 'fast to light' white leathers. Production of syntans in this country—mainly of the type developed by Germany before and during the war—was confined to about half-a-dozen firms and amounted to 5,000 tons per annum, of which 40 per cent was exported. The average price was £50 per ton, compared with £40 for natural tanning extract. Present plants are capable of increasing the amount of synthetic extract available by 25 to 100 per cent.

Synthetics Not Yet Replacements

The investigators also found that a considerable proportion of the synthetic materials produced, while an improvement on pre-war materials, could not yet be regarded as being capable of replacing vegetable tanning extracts. The use of synthetic tans in Germany, which reached a large scale during the war, has fallen off since natural materials have again become available. The increase in the consumption of synthetic tanning materials may be due to a considerable extent to the very high prices of vegetable tanning materials. If these prices fell the demand for synthetics might also fall.

It was found that the total research and development effort devoted to the study of the composition and preparation of natural and synthetic tanning agents at the Research Association, at Leeds University, and in industry, amounted roughly to 15 qualified full-time staff, equivalent to say £35,000 per annum, or 1.5 per cent of the turnover of the tanning extracts industry (£2¼ million).

During the past two years the Research Association has conducted laboratory comparisons of the tanning properties of British, German and American syntans with those of the common vegetable tannins. It has put forward a scheme for a full-scale extension of such comparisons which would cost £5,000 and would require two years to complete.

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The Association's research programme also lists a number of other related laboratory studies—for example, the particle size and chemical constitution of natural tannins and the impregnation of leather with new materials. The director mentioned in Section 3 of his annual lecture in 1948 the need for semi-scale work on tannage with formaldehyde and with basic aluminium salts to evaluate laboratory work already completed.

The report suggests that further consideration should be given by the Council of the Research Association to the proper scale of research and development work in tanning materials of both natural and synthetic origin. The possibility of the Association receiving increased support from the tanning extract manufacturers should be explored.

The leather industry is a considerable user of a variety of chemicals (in addition to tanning agents), of which the most important are sulphuric acid, lime, sodium sulphide and bisulphite, salts of chromium, magnesium, aluminium and ammonium, sulphonated oils, preservatives and dyes. The supply of sulphur and of sulphuric acid, and of chemicals requiring sulphur and sulphuric acid for their production, is absolutely essential to the leather industry. Although this field of usage represents only a small proportion of the cost of the finished leather, these substances enter into the production of the whole leather output of the country. Representations have been made to the Board of Trade to secure adequate supplies.

DSIR Grant

In 1951 the Association had an income of £47,000, which included a DSIR grant of £16,000. Expenditure on research amounted to £48,000. Analysis of the savings resulting from the work of the Association shows that past work is probably benefiting industry at a rate approaching £300,000 per year, and that the major technical items at present on the programme at an annual cost of £29,000 may lead to possible annual savings by the industry of about £600,000. The conclusion is reached that at present the Association's effort is spread too thinly over too many objects, and that increased membership and finance, as well as pruning of the programme, are desirable.

The Analytical Chemistry of Potassium

Part II: The Use of Organic Reagents

By J. W. ROBINSON, B.Sc., A.R.I.C.

AS opposed to the purely inorganic reagents already described, many organic reagents have been used for the determination of potassium.

Tartaric Acid

Tartaric acid gives with potassium ions a precipitate of potassium hydrogen tartrate, but it is not affected by sodium. This reaction formed the basis of one of the earliest known methods for the determination of potassium and has found extensive use in the past.

The normal procedure was to precipitate in the presence of ethyl alcohol to depress the solubilities, filter, wash with ethyl alcohol and dissolve in an excess of a standard solution of sodium hydroxide and back-titrate the unconsumed alkali with standard acid. One of the difficulties with the method was that the precipitate was susceptible to supersaturation and the method was consequently unreliable. Szebelledy and Jonas[1] claimed that this defect could be overcome by using the racemic acid although the sensitivity was unaltered.

Bayer[2] modified the procedure by precipitating with an excess of acetic acid and tartaric acid. After standing, the precipitate was filtered, washed and titrated directly with sodium hydroxide using phenolphthalein as indicator.

Clarke and Davidson[3] developed a rapid method using mechanical stirrers to overcome the supersaturation effect and to effect precipitation before the addition of ethyl alcohol.

The method was satisfactory in the presence of magnesium, but poor results were obtained in the presence of sodium. However, when a mixture of magnesium hydrogen tartrate and tartaric acid was used as precipitant, this difficulty was overcome to some extent.

More reliable and more accurate methods are now available and the reagent is seldom used.

Hexanitro-diphenylamine
(*Dipicrylamine*)

This precipitant is one of the best-known organic reagents used for the determination of potassium. The reagent was first proposed by Poluektoff[4] for the detection of potassium. Winkel and Mass[5] developed a quantitative method which was completed either by weighing the precipitate or by titrating conductimetrically. Kielland[6] used a colorimeric end-point in the analysis of fertiliser. Feigl[7] used the reagent as the basis of a spot test.

An examination of the accuracy of the method as developed by Winkel and Mass was carried out by Portnov and Afansev[8] who reported deviations of 0.5 to 1.5 per cent. Kolthoff and Bendix[9], however, obtained results which were 3 per cent low, which they attributed to the solubility of the precipitate. The difficulty was partially overcome by precipitating at 0°C. and by washing the precipitate with a wash solution saturated with potassium salt.

They found that rubidium, caesium and ammonium salts interfered, but that the latter could be removed by boiling with magnesium oxide. The precipitate itself could be either dried and weighed, or dissolved in a known excess of standard acid, back-titrating the excess with standard alkali. Small amounts of precipitate were determined colorimetrically using calibrated curves.

A modified precedure was developed by Amdur[10] who used lithium hexanitro-diphenylamine solution, saturated with potassium salt, as the precipitating reagent. He completed the determination colorimetrically using the red colour of the salt.

Another colorimetric finish was developed by Belmas[11], who evaporated the potassium solution to dryness, added hexanitro-diphenylamine dissolved in acetone, filtered off the precipitate and determined colorimetrically the excess reagent added, by measuring the intensity of the residual yellow colour. Kohn[12] recommended a similar procedure, except that the precipitate was centrifuged. The accuracy of the method was not given in this paper. The method has been found satisfactory for soil analysis by Lawton[13] who used lithium hexanitrodiphenylamine as a precipitant and determined the excess reagent colorimetrically. Gapchenko and

Sheintsis[14], however, reverted to the Winkel and Mass procedure when analysing fertilisers. Sulphates, phosphates and ammonia were first removed with magnesia. Cotten[15] was also successful in analysing leaf tissue using the procedure proposed by Amdur.

Sandberg[16] developed an amperometric finish to the method. The potassium was titrated directly with sodium hexanitrodiphenylamine at *p*H 12. The results obtained were accurate to within 0.4 per cent in the presence of sodium up to fifteen times the concentration of potassium. He recommended the method for silicate analysis.

Sodium 6-chloro-5-nitrotoluene-3-sulphonate

This compound precipitates potassium from aqueous solution and was first suggested as the basis of a quantitative method by Davies and Davies[17].

A colorimetric method was developed by Wiggins and Wood[18] who also used two titrimetric finishes. In the colorimetric method, the precipitate was dissolved in hot water, passed through a Jones' reductor and coupled with alkaline R salt. This produced a red dye, the intensity of which was measured.

In one titrimetric method, the precipitate was reduced with an excess of standard stannous chloride which was then back-titrated with standard iodine. The second method used an excess of titanous chloride as the reducing agent and in this case the excess was back-titrated with iron alum.

However, the method failed when the potassium concentration was less than 10 g. per litre owing to incomplete precipitation. Ths lower limit has recently been confirmed by Borgioli and Iacozzilli[19]. Ammonium salts interfere since the ammonium ion itself is precipitated and must therefore be previously removed. The procedure also involves standing for 12 hours.

Picric Acid

Potassium is precipitated in alcohol by picric acid, forming potassium picrate, but the corresponding sodium salt is soluble under similar conditions. This has been the basis of several methods put forward for the estimation of potassium.

Minovici and Ionescu[20] took the aqueous potassium solution to dryness. At least 10 mg. of potassium must be present. They then added 2 ml. of water and 8 ml. of alcohol saturated with picric acid, and then 0.5 ml. of glycerol. After standing for one hour, the precipitate was filtered through glass wool, washed with ether, dried and weighed. As an alternative finish, the precipitate was dissolved in water and then estimated colorimetrically or titrated with quinine hydrogen sulphate.

Bolliger[21] modified the procedure by precipitating with calcium picrate and titrating with methylene blue.

Malatesta[22] recommended the use of dimethyl picrate as a precipitating reagent. However, he states that when less than 3 mg. of potassium are present, sodium, magnesium, lithium and calcium, which do not normally interfere, must be previously removed, the sodium being removed by gassing with hydrochloric acid.

Ammonium salts, strontium and barium also form insoluble picrates and must be removed before precipitation.

Naphthol Yellow S

(*2:4-dinitro-1-naphthol-7-sulphonate*)

This is one of the more recent reagents used in this field and a method has been developed based on the insolubility of the potassium salt in water.

One of the difficulties encountered is that the solubility of the reagent in water is low at room temperature, a saturated solution containing only 1.5 per cent of the reagent. This led Clark and Willets[23] to examine the reaction at elevated temperatures where the solubility was increased. They selected 50°C. as the working temperature and used solutions containing 2 per cent and 5 per cent of naphthol yellow S. From this investigation they recommended using the 2 per cent solution, the chief advantage being that no blank was necessary. They found, however, that the 5 per cent solution was quicker in causing precipitation.

With solutions containing 1: 57 mg., 0.39 mg., and 0.03 mg. of potassium, precipitation took place with the 5 per cent reagent after 3 min., 16, and 6.5 hours, respectively. With potassium solutions of the same concentrations, precipitation with the 2 per cent reagent took place after 30 min. and 4 hours for the first two concentrations, but did not appear at all with the most dilute solution.

They also found that the presence of sodium increased the standing time and gave rise to a finer precipitate but did not otherwise interfere. Ammonium ions caused slight precipitation after 48 hours. The effect of caesium and rubidium was not examined.

These long standing times make the method lengthy for quantitative work. However, Frediani[24] has successfully applied the reagent as a microscopic test. Solutions containing 7.5 mg. or more of potassium gave a positive test immediately; more dilute solutions took longer.

One difficulty with the test was that other alkali metals gave crystals very similar to those produced by potassium and it was impossible to distinguish one from the other.

Dinitro-β-Naphthol Sulphonic Acid

This compound, which precipitates potassium quantitatively, was examined by Volotschneva[25]. As a result of this work he finally proposed a method in which the precipitate was filtered, digested in sulphuric acid and finally weighed as potassium sulphate. In this method, rubidium, ammonium and lithium interfered, but magnesium and sodium interfered only if present in high concentrations.

Dibenzofuran Sulphonic Acid

This compound precipitates potassium from solution and the reaction was examined by Wendland and Smith[26]. They proposed a method based on this which is, however, limited in application, since many other metals also precipitate under the same conditions. In their papers seventeen such metals are listed.

Leuconic Acid

(*Decahydroxy-cyclopentane*)

The properties of this acid, with special reference to its polymerisation properties, were examined by Philpot, Graham-Horgan and Watson[27]. It was found that the potassium salt of the acid and of its pentamer, were insoluble. On this basis they recommended that the reagents should be examined with a view to deriving a quantitative procedure for the estimation of potassium.

Sodium 1-amino-2-naphthol-6-sulphonate

The use of this compound as a potassium precipitant was examined by Alverez[28]. It was found that precipitation took place immediately if the concentration of the potassium was greater than 2 per cent.

One serious disadvantage of the reagent is that the solution must be used immediately it is prepared, since it is unstable in solution.

5-Nitro-Barbituric Acid

This compound has been recommended by de Graaf and Noyons[29] as a precipitating reagent for potassium. They claimed that it would detect as little as 0.02 mg. of potassium/ml., but the determination cannot be carried out in the presence of sodium, rubidium, ammonium, magnesium or barium.

Lithium Boro-tetraphenyl

$LiB(Ph_4)$.

This precipitant was advanced recently by Wittig, Keicher, Ruckert and Raff[30]. The compound is prepared by shaking together lithium phenyl and boron triphenyl for three months. The authors of this paper claim that the compound gave quantitative precipitation with rubidium, caesium, ammonium and potassium, but not with sodium. The present method of manufacture of the reagent, however, seem to preclude any method proposed from becoming widespread.

Other compounds which deserve mention in this branch of analytical chemistry include lakaonic acid which was proposed by Gutzeit[31]; 2-hydroxynaphthalene-1-azonaphthalene-4-sulphonic acid proposed by Tischer[32]; and 4: 6-dinitrobenzofuran which was proposed by Rathberg and Scheuser[33]. However further work needs to be done to produce a satisfactory method in each case.

Nitrilo-triacetic Acid

$N(CH_2COOH)_3$.

This compound has been examined by Scharzenbach[34] who found that an insoluble precipitate was formed with potassium. He claimed that this precipitate was suitable for a gravimetric, colorimetric or titrimetric finish.

General Conclusions

It can be seen that, as with inorganic reagents for potassium, many of these organic reagent give rise to methods which are lengthy and troublesome. There is also the difficulty of interfering elements, whose effect has yet to be overcome using either variety of reagent. There is, in fact, still a pressing need for a reagent which can be used to estimate potassium rapidly and accurately.

(*To be continued*)

REFERENCES

[1] L. Szebelledy and J. Jonas, Z. *Anal. Chim.*, 107, 114, (1936).
[2] E. Bayer, *Chem. Z.*, 17, 686 (1893).
[3] L. Clarke and J. M. Davidson, *Ind. Eng. Chem.* (*An. Ed.*), 3, 324 (1931).
[4] N. S. Poluektoff, *Mikrochemie* 14, 265 (1933-4).
[5] A. Winkel and J. Mass, *Angew Chem.*, 1936, 49, 827.
[6] K. Kelland, *Ber.*, 718, 220 (1938).
[7] Feigl and Mattews, 'Spot tests'
[8] M. A. Portnov and S. K. Afansev, *Zav. Lab.*, 6, 1442 (1937).
[9] I. M. Kolthoff and G. H. Bendix, *Ind. Eng. Chem.* (*An. Ed.*) 11, 94, (1939).
[10] E. Amdur, *ibid.*, 12, 731 (1940).
[11] R. Belmas, *Rev. Gen. Caoutchouc*, 26, 341 (1949).
[12] W. Kohn, *Z. anal. Chem.*, 128, 1 (1947).

[13] K. Lawton, *Soil Sci. Soc. Am. Proc.*, **10**, 126 (1946).
[14] M. V. Gapchenko and O. G. Sheintsis, *Zav. Lab.*, **14**, 410 (1948).
[15] R. H. Cotten, *Ind. Eng. Chem.* (*An. Ed.*), **17**, 734 (1945).
[16] B. Sandberg, *Svensk. Kem. Tid.*, **58**, 197 (1946).
[17] H. Davies and W. Davies, *J.C.S.*, **123**, 2976 (1923).
[18] W. R. Wiggins and C. E. Wood, *J. Inst. Pet. Tech.*, **21**, 200 (1935).
[19] N. Borgioli and R. Iacozzilli, *Chemica* (*Milan*), **3**, 359, (1948).
[20] Minovici and A. Jonescu, *Bull. Soc. Chim. Rom.*, **3**, 25 (1921).
[21] A. Bolliger, *J. Biol. Chem.*, **107**, 229 (1934).
[22] L. Malatesta, *Gazz Chim., Ital.*, **77**, 147 (1947).
[23] A. W. Clark and C. O. Willits, *Ind. Eng. Chem.* (*An. Ed.*), **8**, 209 (1936).
[24] H. A. Frediani, *ibid.*, **10**, 447, (1938).
[25] D. Volotschneva, *J. App. Chem. Russ.*, **11**, 369 (1938).
[26] R. T. Wendland and C. H. Smith, *Proc. N. Dakota Acad. Sci.*, **2**, 40, (1949).
[27] J. St. L. Philpot, V. J. Graham-Horgan and J. Watson, *Research* (*London*), **1**, 273 (1948).
[28] Y. Alvarez, *Chem. News*, 1905, **91**, 146.
[29] C. L. de Graaf and E. C. Noyons, *Chem. Weekblad.*, **43**, 300 (1947).
[30] G. Wittig, G. Keicher, A. Ruckert and P. Raff, *Ann.*, **563**, 110 (1949).
[31] G. Gutzeit, *Helv. Chim. Acta.*, **12**, 713, 829 (1939).
[32] J. Tischer, *Mikrochemie*, 148 (1936).
[33] A. Rathberg and F. Scheuser, *Die. Chemie.*, **56**, 123 (1943).
[34] G. Schwarzenbach, *Helv. Chim. Acta*, **29**, 1338 (1946).

Design & Development

Deducing Knowledge of Requirements

OBJECTS and details of the design of chemical plant were outlined by Dr. J. F. C. Gartshore in a paper 'The Function of Design in Development' presented to a meeting of the Institution of Chemical Engineers (North-Western Branch) held in Manchester on 29 March.

To illustrate his principles the speaker gave a description of plant to purify anthracene. Design, he said, really consisted of two forms, basic and detailed.

Basic design was the general description of a plant in terms of volumes of tanks, heights and diameters of towers, surfaces of heat exchangers, rates of flow of materials and energy, and constructional materials. Detailed design, however, completely specified the plant. Basic design had two aspects, a deliberate preliminary to a detailed design and a concept of the appearance of a plant when it was finished. Such a design was called proleptic and was used to deduce what further knowledge was required, to examine the performance of a plant, to find its economic advantages and its workability, and to decide on data required for true basic design. Technical data, flow sheets and basic design were given for a process of purifying anthracene.

Design might be used for comparison of capital and operating costs of a proposed plant with other known processes. If the comparison was favourable, the development work was planned. Dr. Gartshore distinguished between pilot and semi-technical plants. Pilot plants were designed to make products for sale, while semi-technical plant was to produce data for future plant design.

Pilot plant was intended to work on a production routine and its stages must balance each other. The semi-technical plant, on the other hand, need not work as a whole, stages of manufacture were investigated in easily built and easily controlled plant. This plant showed if the stage would work or if it worked in the expected way. it yielded data on shape, size and constructional materials. The stages that were most costly and those that were most difficult to operate were also revealed. The author dealt with costing and its use and accuracy in comparing a new process with an old one.

New Colour Index

PRODUCTION of a new colour index in five volumes was announced by Mr. H. Bowen, president of the Society of Dyers and Colourists, at the dinner held in Leeds on 28 March, following its 68th annual general meeting.

The index would cost between £85,000 and £95,000, and it was hoped it would be published in 1955. Owing to the high cost of paper in this country, permission had been given by the Board of Trade for this to be purchased in the U.S.A.

A difficult period of world-wide recession was facing the textile industry at present, continued Mr. Bowen, and the British section was confronted with a grave challenge. One of the chief problems was how to maintain the reputedly high quality of British goods, while at the same time trying to incorporate higher productivity.

Mr. William Kilby, of Standfast Dyers and Printers, Lancaster, was presented with the society's gold medal for his work on the development of a molten metal process of continuous dyeing.

The following officers were elected:—*President*: H. Bowen; *hon. treasurer*: H. Jennison; *hon. secretary*: J. Barritt; *vice-presidents*: Professor J. B. Speakman, G. B. Angus, C. O. Clark and H. Foster; *members of the council*: J. Boulton, A. Breare, Dr. G. T. Douglas and F. Jordinson.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

Aluminium Research Progress

D. Lees Reviews Field for Leeds Metallurgical Society

THE difficulty of keeping pace with the volume of published work on metallurgical subjects is nowadays so great that specialist reviews are increasingly valuable and it was therefore welcome that at a meeting of the Leeds Metallurgical Society held at the University on 6 March, Mr. D. C. G. Lees, of the Aluminium Development Association, presented a paper on 'Some Recent Research on Aluminium and its Alloys'. Mr. F. K. Neath, president of the Society, was in the chair.

Remarking that in keeping with the growing importance of aluminium a large proportion of the papers published in journals devoted to non-ferrous metals was now concerned with aluminium, Mr. Lees emphasised that he was selecting a few subjects for special treatment, rather than giving a comprehensive review of progress. The chosen subjects were: factors influencing the cast structure and its effect on technical properties; the search for alloys of higher strength; investigations on aluminium of the highest purity and on alloys made from it and, lastly, some recent progress in the technical field.

Grain Size Refinement

It had been known for many years (he said) that the grain size of aluminium alloys can be refined by adding small proportions of titanium, niobium or boron, although the cause of this refinement was not well understood. Investigations by M. D. Eborall and A. Cibula, of the British Non-Ferrous Metals Research Association, since 1945, had gone far towards supplying the explanation and it now appeared that in the presence of grain-refiners, crystallisation was nucleated by minute particles of titanium carbide or aluminium boride whose lattice structures approximated to that of aluminium itself; when these elements were present, the normal undercooling was suppressed. Earlier explanations based on the peritectic reaction did not accord with the experimental observations.

Some of the high-purity heat-treated aluminium casting alloys (mainly the 4 per cent copper and the 10 per cent magnesium alloys) are known to give somewhat variable tensile properties in test bars and it has been shown by Cibula and R. W. Ruddle that these variations may be related to the grain size. This grain size effect is due to the fact that the inevitable small amount of shrinkage porosity is of a somewhat different form in coarse and fine grained material, the more rounded type occurring in the latter being less damaging to tensile strength.

Desirable Qualities in an Alloy

Turning to his second subject, Mr. Lees remarked that mechanical strength was only one of a number of desirable qualities in an alloy and that a compromise had to be sought between strength, ductility, ease of manufacture and other necessary properties. Already, an advanced stage in alloy development had been reached as was shown by the fact that there were alloys with a tensile strength of eight or nine times that of the annealed pure metal; this compared well, for instance, with what had been achieved with steel.

Much of the work on stronger wrought alloys had been devoted to the aluminium-zinc-magnesium series and a short account was given of research by M. Cook, R. Chadwick and N. B. Muir in England, and J. Hérenguel in France. H. K. Hardy had recently studied the age-hardening characteristics of the aluminium-copper alloys and had shown that higher strength might be developed after precipitation heat-treatment if 0.05-0.10 per cent of cadmium, tin or indium was added.

Aluminium analysing 99.99 per cent or higher was now being used in increased quantity for a variety of purposes such as flashings and weatherings and reflectors.

As normally supplied, 'super-purity' aluminium was about 99.993 per cent pure and when heavily cold-worked, recrystallised at about 150° C., but if the purity reached 99.998 per cent it might be self-annealing at room temperature. H. Chossat of the Vitry laboratory in France had made a detailed study of this subject showing that the temperature of recrystallisation was strongly influenced by the first traces of impurity and that subsequent larger additions had a much smaller effect. Other French work, by J. Hérenguel, had been devoted to the alloys of super-purity aluminium with magnesium, which gave beautifully clear anodic oxidation finishes capable of being dyed so as to resemble gold, for example.

In the last section of his lecture, Mr. Lees outlined some recent progress in technical processes, beginning with welding. The notable development of argon arc welding was mentioned, the lecturer remarking that by dispensing with flux, this had made it possible to realise designs which would otherwise have been impossible, because of the need for thorough removal of flux residues. Further, developments in welding such as 'Aircomatic' and stud welding as applied to aluminium were also referred to.

Turning to surface treatment, Mr. Lees said the most significant advances were thought to be F. A. Champion's work on the metal spraying of castings and extruded sections and W. J. Campbell's development of hard surfaces by anodic oxidation in such a manner as to form a film 0.003 in. or more in thickness.

A discussion followed in which questions were asked on methods of producing grain refinement by treatment with borofluorides and titanofluorides, the hardness of the heavy anodic oxidation films, research on Young's Modulus and other matters. A vote of thanks to Mr. Lees was proposed by Dr. N. J. Petch, Reader in Metallurgy at the University of Leeds, and seconded by Mr. Butterwick.

Unwrought Copper Cheaper

Reduction in the price of secondary unwrought copper other than electrolytic and fire refined ingot bars and wire bars, and cathodes from £200 to £185 was made by the Minister of Supply in an Order which came into effect on 1 April.

New U.S. Standard Sample

Analytical Standard for Chrome Ore

AN industrial standard sample for metallurgical chrome ore has recently been established through a co-operative study by several of the leading metallurgical, commercial, and chemical laboratories experienced in chrome ore analysis in the United States, Canada, and the Union of South Africa. The careful analysis of the ore, containing 50.96 per cent Cr_2O_3, for chromic oxide, iron, silica, alumina, and magnesia has filled a long-expressed need of the industry for a reference standard having a chromic oxide content higher than that of the chrome refractory containing 36.97 per cent Cr_2O_3 now obtainable from the American Bureau of Standards. Portions of the sample and copies of the analysis certificate are available without charge to industrial and commercial laboratories directly concerned with chrome ore analysis, upon application to Merton H. Davey, Andrew S. McCreath and Son, Harrisburg, Pa., U.S.A.

Preparation of Sample

The sample was prepared by thorough mixing of a finely ground sample of Turkish chrome ore, and after preliminary tests for chromic oxide and iron on several portions of the sample by two laboratories had established its uniformity, samples were distributed to the co-operating laboratories for analysis. The analyses were correlated and the analysis certificate prepared by the Research Laboratories of the Mutual Chemical Company of America, Baltimore, Maryland. The laboratories participating in the analyses were: Booth, Garrett, and Blair, Philadelphia; Canadian Refractories Ltd., Montreal, Canada; E. J. Lavino and Company, Norristown; Ledoux and Company, New York; Andrew S. McCreath and Son, Harrisburg; Mutual Chemical Company of America, Baltimore; Ohio Ferro-Alloys Company, Philo, and Tacoma; Standard Bank of South Africa, Johannesburg; Union Carbide and Carbon Research Laboratories, Niagara Falls, and Vanadium Corporation of America, Niagara Falls.

Details of the preparation of the sample, are contained in a paper which has been prepared for publication by Winslow H. Hartford, Mutual Chemical Company of America.

Canada's Chromium Problems

Low-Grade Domestic Ores Investigated

UTILISATION of chromite ores and concentrates of low chromium-iron ratio to their best advantage has been the subject of investigation in many laboratories in Canada during the past few years. A survey of the general problem with details of the more promising beneficiation methods by K. W. Downes and D. W. Morgan (section head and metallurgist, respectively, of the Extractive Metallurgy Section, Division of Mineral Dressing and Process Metallurgy, Mines Branch, Ottawa), has now been issued by the Department of Mines and Technical Surveys, Canada (Memorandum Series, No. 116, October, 1951).

This investigation was undertaken because of the dependence of the North American continent upon overseas deposits of high-grade chromite, the only commercial sources of chromium for industry. Should supplies of chromite from abroad be cut off during any emergency it would be necessary to use domestic ores, which are almost entirely low-grade and of low chromium-iron ratio. It was desired to find a method of employing these ores without incurring excessive costs, and particularly without reducing the production capacity of that part of the economy affected.

Processes Too Expensive

Although none of the processes investigated was considered cheap enough to encourage the exploitation of domestic resources under normal conditions, methods of beneficiating chromite which had been advanced to the laboratory stage were believed quite satisfactory to meet emergency requirements for a concentrate of high chromium-iron ratio. Methods of directly utilising concentrates of lower ratio which did not unduly hinder production capacity were available for use in certain applications.

After a brief survey of chromium metallurgy it is shown how chromite enters industry in the following ways. First, as an alloy with iron and steel for metallurgical grade ore requiring a chromic oxide (Cr_2O_3) content of 48 per cent and a chromium-iron ratio of 3: 1, or as off-grade metallurgical chromite ore having a chromium-iron ratio less than 3: 1.

Secondly, as a refractory, when its acceptance is based primarily on actual performance rather than on chemical composition. In general FeO should be less than 16 per cent, Cr_2O_3 more than 30 per cent and SiO_2 less than six per cent.

Finally, as a source of chromium chemicals. Here, the specifications required are not as rigid as for the metallurgical grade. In general, the minimum content of Cr_2O_3 should be 44 per cent Al_2O_3, 20 per cent FeO or three per cent SiO_2.

Chromite Ore Data Summarised

The report summarises the pertinent data regarding the extent of the Canadian and North American reserves of chromite ores, their quality, and possible uses, and methods that have been suggested for their beneficiation.

Although most of the information exists in the literature, the investigations of the Mines Branch and of Hudson Bay Mining and Smelting Co., Ltd., have not been published. Since these methods appear to have possibilities as large-scale chromite beneficiation processes, they are given quite extended treatment so that the data on which the final conclusions have been reached can be examined independently.

It is known that the Bird River and Montana deposits, the two largest deposits of chromite on the continent, can be mined and concentrated mechanically by tabling or by combined tabling and flotation to produce a concentrate containing about 40 per cent Cr_2O_3, chromium-iron ratio 1.3: 1 to 5: 1, with a recovery varying from 78 to 89 per cent. No unforeseen difficulties need be expected in these operations. The time required to attain the necessary production of concentrates from these two deposits has been estimated at somewhat under two years.

These concentrates could be converted into high- or low-carbon Chrom-X, in which form they could satisfy the metallurgical needs of the continent.

Alternatively, the concentrates could be added directly to steel, using the Wild process which avoids the use of ferrochrome.

In an emergency when maximum steel production was required it might be

desirable to beneficiate the concentrates chemically to allow them to fit in with standard practice. To determine whether the chromite should be utilised as Chrom-X, or in the Wild process, or should be beneficiated to some degree, calls for a careful balance of the metallurgical and economic factors of the case under consideration.

In the Mines Branch laboratories two new methods for beneficiating domestic chromite concentrates have been worked out, namely, oxidation to chromate and reduction of the chromate with carbon, and pressurised leaching with sulphuric acid. These processes compared favourably with others which were known both with regard to their technical feasibility and their economy in application.

Modifications to the United States Bureau of Mines process of roasting chromite concentrates with carbon and leaching with sulphuric acid which had been developed by the Hudson Bay Mining and Smelting Company, were made available to the Mines Branch. These were carefully checked, fully confirmed and somewhat extended. The process appeared to be the simplest and most economical so far proposed.

It may be concluded that chromite concentrates, obtained by the mechanical concentration of domestic chromite ores, can be beneficiated, raising the chromium-iron ratio to 3 : 1 if desired. And in view of the extensive pilot plant work done by the U.S. Bureau of Mines on its version of the process, no great technical difficulties need be expected in a commercial scale operation. For a few years at least, depending upon the extent of the ore deposits, and subject to a one- to two-year delay while the mines develop full production, the North American continent can supply its chromium requirements from its own resources.

Cathodic Protection

A Standard Form for Buried Metals

A STANDARD form for describing cathodic protection installations to safeguard underground pipe lines against corrosion in this country has been prepared by the British Iron and Steel Research Association's Sub-Committee on the Corrosion of Buried Metals.

Replacement of corroded underground pipes is estimated to cost this country £50,000,000 per year. Cathodic methods of protection as used, for example, on the £2,000,000 oil pipeline from Finnart to Grangemouth in Scotland, show promise of becoming an economic and effective way of cutting this bill. Application of the method, however, will only be effective if the fullest possible information on the subject is examined, correlated and made available to all interested bodies. The most convenient body to do this is the BISRA Sub-Committee (chairman, Mr. L. C. Whiskin, of the Metropolitan Water Board) which has been entrusted by the Minister of Health with the co-ordination of research on this subject.

The form which can be treated as confidential if desired, is in the form of a questionnaire on the protected pipeline and the site in which it is laid, the details of any cathodic protection and the conditions before and after its installation, with details of corrosion failures, repairs, etc. It is available from Mr. E. E. White, BISRA, 140 Battersea Park Road, London, S.W.11, and is to be returned when completed to the Chemical Research Laboratory, Teddington.

It is hoped that the form will be widely used to enable the Sub-Committee to obtain a clear picture of the extent and effectiveness of cathodic protection of buried pipelines in this country.

Increased Interest in Wolfram

The British Ministry of Materials has entered into a contract with Aberfoyle Tin N.L., Tasmania, for the entire output of its wolfram concentrates and residues for a period of four years at current market prices with a guaranteed minimum. A new wolfram field reported 50 miles from Hatche's Creek is being thoroughly investigated. In the Northern Territory a treatment plant on Mosquito Creek field is nearing completion and is expected to go into operation shortly. Stimulated interest in mining is also to be witnessed in King Island and New Zealand. In December, 1951, 8,862 tons of ore were treated at Aberfoyle producing 16.5 tons of concentrates while King Island Scheelite accounted for 77.4 tons of concentrates in the same month from 11,670 tons of ore. The peak production of the latter was in October, 1951, when 964 tons of concentrate were obtained.

Some Facts About Gallium

Frenchman Reviews Present Knowledge

THIS element, predicted by Mendeleeff as *eka*-aluminium to fill a gap in the Periodic system, and the properties of which he accurately foretold, was discovered about 1875 by Lecoq de Boisbaudran through his spectroscopic studies, and called gallium in honour of France. Another Frenchman, Dr. Maurice Beja, has now reviewed our present knowledge of this element in an address to the Centre du Perfectionnement Technique last year (*Chimie et Industrie*, 1952, **67** (1), 45-55, January). It is a fairly comprehensive survey based on some fifty-six references, beginning with a brief historical note and giving its principal sources—from germanite, aluminium ores (bauxite) and coal ash in England—and its properties. The Bayer method of recovery as improved and developed by the Cie. Péchiney is dealt with at some length, on the basis of the various patents taken out by this company and others—including one that, at the time of this report, had not been published (Brev. franc. No. prov. 607,447—2 April, 1951). With a French production of 80,000 tons of aluminium in 1951, using 400,000 tons bauxite (25 g. gallium per ton) there was a total yield of gallium of about 10 tons in the French Bayer works; and with a world total of 1,500,000 tons of aluminium, yield of gallium would be approximately 200 tons.

Method of Obtaining Gallium

There is little difficult in obtaining metallic gallium from pure hydrated galline. This is done by dissolving the galline in caustic soda solution to give 50 g./litre of gallium and slight soda excess, then electrolysing, preferably at a temperature above 39°C. It should be mentioned here that gallium is a silver-white metal of very low m.p. (30.15° C.), and remains permanently as a supercooled liquid at ordinary temperatures, unless contacted with the solid. Solution of sodium gallate and aluminate may be electrolysed under suitable conditions. The metal may be further purified by treatment with nitric acid and fractional crystallisation; although usually the electrolytic product is up to 99.9 per cent pure. Its boiling point is hardly yet definitely known, but is in the neighbourhood of 2,000°C., and thus resembles tin in having a very wide liquid phase range (tin b.p. is 2,275°C., m.p. 232°C.).

Cooled Without Crystallising

Gallium may be cooled well below its melting point without crystallising: it exhibits the curious property of surfusion or supercooling, especially marked in gallium dispersions in alcoholic sodium oleate, which as D. Turnbull found, can be cooled to −40°C. without crystallising (*J. Appl. Phys.*, 1949, 817). Various other physical and electrical properties are indicated. The density of solid gallium is 5.904 and of liquid gallium 6.095 at its melting point. It increases in volume in passing from liquid to solid, a very rare property in metals, and one shared only by bismuth and antimony. This permits very high pressures to be attained at the low temperatures approximating those of liquid helium, namely, 10,000 kg./cm² (Lazarev and Karn, *J.Phys. U.S.S.R.*, **8**, 193-200).

Recent research has shown that gallium is anisotropic, and certain physical constants vary according to crystal axes (Powell, *Nature*, Lond., 1949, **164**, 153-154). Some interesting work, too, has been done with gallium mirrors which are very brilliant with remarkable reflective powers. Numerous spectroscopic studies have been made. As to its chemical properties, these in many respects resemble those of aluminium. Pure dry oxygen has little effect up to 260°C.; the metal does not lose its lustre until heated to nascent redness, when it becomes coated with a greyish-blue film; oxygen-free water has no action on it even when boiling; acids, alkalies, and halogens generally attack it, with one or two exceptions—for example, acid in the cold, even when concentrated, has little effect. Gallium, like aluminium, forms colourless compounds that are trivalent, but unlike aluminium, also forms compounds in its bivalent state, such as the chloride $GaCl_2$, and a monovalent oxide Ga_2O (*see* also *Rep. Chem. Res. Board*, London, 1947, 1948).

A considerable amount of research has been done on the gallium isotopes, and

published in the *Phys. Review* since 1937, in publications by the G.E.C. and elsewhere. Ordinary gallium, of which the atomic number is 31 and the average atomic weight 69,72, consists of two isotopes (at wts. 69 and 71, respectively 61 and 39 per cent). This proportion holds, too, in meteoric gallium. The number of isotopes has been greatly augmented by nuclear physics in various ways (*Phys. Rev. ibid*).

Nearly all the metals of the Periodic Table have been tested with regard to their alloying powers with Ga, and both binary and higher combinations have been formed. Those of Group III have been found the least responsive. These alloys so far have found little practical use except perhaps in some dental alloys, for example, those of Bi-Ga-Sn. Some medicinal uses are briefly noted for gallium and its compounds. The chemical analysis of gallium is described in some detail with numerous literature references; also its various possible uses: thermic, optic and electrical, and for $GaCl_3$ in organic synthesis.

Last year the price of gallium in France was about 1,000 frs./g., and the author considers this high price a deterrent to expanding uses, as no doubt it is. At the same time much interest is being shown in England, the U.S.A. and Russia in possible applications for gallium, its alloys and compounds, and possibly also its isotopes.

New Metallograph

All Operations Controlled from Desk

A NEW desk-type metallograph permitting microscopic study of metals under polarised light as well as under phase and bright field illumination has been announced by the American Optical Company, Instrument Division, Buffalo. One feature is that every operation may be performed while sitting at the desk and each control is within easy reach. Final focusing for photography is accomplished automatically and accurately while examining the specimen through the parfocal visual system.

Included in the equipment are: a quadruple revolving nosepiece for rapid changing of objectives; automatic, motor-driven arc lamp, easily and accurately adjustable; a separate, built-in illuminator for visual examination; and four special photographic eye pieces. No charts or tables are needed for determining optical settings, it is stated. The research-type rotating stage has verniers graduated in degrees, and built-in co-ordinate motions, 20 mm. in each direction.

A specially coated reflector is used in the vertical illuminator, yielding plane polarised light free of disturbing elliptical polarisation. A slot receives compensators and phase annular diaphragms. Built-in polariser and rotating analyser are constructed of special quality polaroid. Full- and quarter-wave compensators are standard, making possible striking colour differences to accentuate slight differences in contrast. A phase (diffraction) plate is built into the same slide as the analyser. The vertical illuminator focusing lense permits sharp focus of the annular diaphragm on the phase plate.

Asbestos in Venezuela

RESOURCES totalling some 4,000,000 tons as asbestine, the raw material from which asbestos is made, remain unexploited in the State of Cojedes, Venezuela, according to Sr. Garlos Paradisi, director of the Mines Department of the Venezuelan Ministry of Mines. This is sufficient to produce as much as 4,000 tons of asbestos a year for the next 15 years, which, at an average price of some £100 per ton, is attractive for any exploiting company, he says. Asbestos production in Venezuela began in 1946, when 65 tons were produced. Some 42 concessions were made in Cojedes, of which most were allowed to lapse before the full resources were known.

One big concession was leased from 1938 to 1945 to a British firm, Messrs. Turner and Newall, Ltd. During that time the firm is reported to have spent some £50,000 in exploratory work, and planned eventually to invest about £1,000,000, but was forced to abandon the plan in 1945 because it could not export capital from Britain. The early exploratory work of this company, however, showed the existence of some 2,000,000 tons of reserves.

It is possible, says Sr. Paradisi, that the pressure of present market conditions may mean that the difficulties of exploitation which have existed up to now will be overcome. There is today the incentive of the highest prices for asbestos ever recorded.

Microbes & Corrosion

Italian Summarises Results of Recent Studies

THE microbic cycles of sulphur and of iron and manganese in the soil have long been of keen interest to students of soil and its fertility, and more recently have also evoked considerable interest in connection with metallic corrosion. G. Banfi, of the Montevecchio Microbiological Centre, Milan University, has reviewed some of the literature of the subject and summarised his own work in this field. (*La Chim. e l'Ind.*, 1952, **34** (1), 17-21).

No Agreement

There is by no means general agreement as to the precise nature of the action which occurs in the precipitation of insoluble compounds of Fe and Mn. According to Cohn, Winogradski and others, such precipitation is a typically vital operation, and the required energy is derived from an exothermic oxidation of the ferrous compounds, favoured or stimulated by the presence of ferrous carbonate in the water. On the other hand Zopf and Molisch have envisaged other possibilities.

The wide and varied distribution of sulphur in the soil has been studied by many, and the content ranges within large limits both in an organic and inorganic form. It is the material for much microbic activity, mostly oxidation or reduction—according to Waksman, who classified the relevant microorganisms into four groups. The work of A. Helbronner and W. Rudolfs on the microbic oxidation of zinc blende (ZnS) (*Comptes Rendus*, 1922, **164**, 1378) is described at some length. Other work noted is that of Arnaudi and of R. and L. Grandori who studied the waters of Lake Caprolace and their microbic fauna (or flora), various forms of which were isolated. Special reference is also made to the paper by T. H. Rogers on the promotion and acceleration of metallic corrosion by micro-organisms (*J. Inst. Metals*, 1948, **75**) which aroused much interest and discussion, e.g., by Evans, Voce, Gilbert and others.

The author's own work, of which fuller details are published in *Annali de Microbiologia*, 1952, **5** (1), was undertaken mainly with zinc and its alloys, with a view to confirming the known data and also to differentiating, if possible, microbic activities that might be new and of particular interest. Various experimental techniques were used concentrating mainly on one species, namely *Vibrio desulphuricans*, isolated from spring water. Cultures were prepared with Van Delden nutrient containing pure magnesium sulphate (1 per 1,000). By selective growth very active organisms were obtained, producing H_2S in abundance. From the mixed cultures were isolated (at 75-80°C.) gasogenic, sporiferous, anaerobic organisms, mainly of typical *Vibrio* form, and doubtless capable of liberating carbon dioxide from carbonic hydrates. A series of cultures in test tubes were prepared and contacted with zinc under anaerobic conditions. The Zn was in strips 0.10 mm. thick and 70 by 25 mm. surface, and these were partly immersed in one series and wholly immersed in another. In a control series the strips were immersed, partly or wholly in sterilised liquid.

Temperature was maintained at 15-17°C. After about 10 days, microbic activity became manifest, with blackening of the saline deposit (containing traces of ferrous sulphate). With the partially immersed test-pieces, after about 15 days, blackening was seen in varying degree, increasing somewhat with time; also a lighter or whitish coloured deposit near the edges (tube walls) which increased in volume with time. Except for this formation of sulphate there was little visible evidence of attack, at least for a month; then there appeared very small patches of apparent corrosion. Such small patches, but more numerous and uniform also appeared in about a month on the totally immersed specimens.

Conclusion

From the results the author concludes that:

(1) Since the test-pieces contain Pb (0.146 per cent) and traces of Fe, Cu, Cd, Ni (Zn 99.83 per cent), the black formations in the partially immersed specimens show that reactions take place between Pb, Fe and H_2S and to some extent mask the Zn reactions at

first; though these become more evident with ageing of the culture.

(2) The main point of activity is that where air, the liquid surface, and H_2S are in direct contact with the metal. More than one reaction may take place in this limited zone—they are not easy to control.

In samples treated with cultures definitely aerobic there is a slowing up of the typical reactions so that the presence of sulphates on the metal is limited to a few traces. Other possibilities are discussed in connection with aerobic organisms and completely immersed zinc specimens, more particularly with reference to the formation and reduction of sulphates.

(3) With regard to the immersed zone, this presents an area sometimes more or less liable to attack, without trace of sulphates; and it seems reasonable to suppose that electrochemical action may take place.

Some notes are added on the action on zinc of aerobic organisms of the type of *Flavobacterium sulphureum*, rod-like forms found in the air, in the soil, and in water. Some experiments are in hand with cultures of these bacteria from sea-water and soft water. The author observes that, as experience shows, determination of weight of metal attacked, of weight of corrosion products, or of area attacked and penetration, are valuable indications of the corrosive process and of the differing behaviour of metals; yet, strictly, a true measure of tendency to corrode should include effects on mechanical and dynamic properties such as elongation or tensile strength, etc. Various lines of experiment remain even yet insufficiently explored, and research continues.

Metal Finishing Group

Electrodepositors Widen Activities

THE Electrodepositors' Technical Society has recently become an incorporated body under the title of the Institute of Metal Finishing. As such it will extend its activities into the field of organic finishing generally. The emphasis will be on the process side and technology of metal finishing rather than the chemical, which is admirably covered by such bodies as the Oil and Colour Chemists' Association and the various paint trade bodies. From the point of view of those engaged in the practice of metal finishing using organic coatings, there has hitherto been no adequate forum for the discussion and dissemination of information.

As is well-known, a considerable number of members of the Institute, indeed the majority, are already directly interested in organic finishing as they are concerned with practically all aspects of the finishing of metals, and not only with the electrodeposition. Many of the technical meetings held in the past have been devoted either wholly or in part to methods of metal finishing outside electro-deposition.

The Institute will continue its policy of being completely independent and free from commercial attachments, it announces. Its fundamental tasks are the publication of technical papers, the arrangement of meetings and conferences, and any other activities that may serve to spread knowledge and increase the efficiency of industrial practice.

At a preliminary meeting held recently between a number of individuals interested in organic finishing and members of the Council of the I.M.F. it was decided that the best way to implement these objectives would be to form an Organic Finishing Group open to all members of the Institute. To inaugurate this Group a Delegate Committee, as representative as possible of the industry, will be appointed to organise a conference in the Autumn of 1952. This will be partly a technical and partly a business meeting at which the election of the Committee and Officers of the new Group will take place. A further announcement will be made in due course.

Sulphur Prices Lowered

THE Minister of Materials has made an Order, with effect from 1 April, 1952, reducing the maximum prices of ground sulphur. In addition, from that date, the maximum prices will no longer include an amount to cover the cost of the bags or other form of package. The seller may now charge the cost of the bag or package provided the amount of such charge is shown separately on the invoices.

The net reduction, after allowing for bags being charged separately, is on average £1 14s. 0d. per ton or approximately seven per cent on current prices, and results mainly from decreases in freight rates on sulphur.

Copies of the Order, The Ground Sulphur (Prices) Order, 1952 (S.I. 1952, No. 646) are on sale at H.M. Stationery Office, price 2d.

Raw Material Scarcity Hits Steel Industry

Value of Practical & Fundamental Research

RAW material shortages adversely affected the output of steel in 1951, but nevertheless the total of 15,638,000 tons was the second highest ever achieved in a single year. One of the most serious difficulties, according to the 'Annual Report, 1951' of the British Iron and Steel Federation, published this week, was the reduction in deliveries of scrap from Germany, supplies being only 475,000 tons compared with 1,815,000 tons in 1950.

Pig iron production, at 9,669,000 tons, was slightly below the estimate for the year, owing to ore shipping difficulties in the early months and, after these had been overcome, to a coke shortage as pig iron output expanded to higher rates towards the end of the year. Production had recently been running at an annual rate of 10,280,000 tons.

The year 1951 would long be remembered for the many serious problems which it brought to the iron and steel industry. The transfer to the Iron and Steel Corporation of Great Britain, on 15 February, of the ownership of some 80 of the largest iron and steel producing companies, together with their subsidiaries, brought organisational problems not only for the federation but also for the individual companies.

Proposed Supervision

The precise form of public supervision proposed by the Government which came into power in October 1951 had not been announced at the turn of the year, but it was expected that an Iron and Steel Board, possibly with extended powers, would be re-established over the whole industry.

Under the auspices of the Anglo-American Council on Productivity, a team representing the iron and steel industry spent five-and-a-half weeks visiting steelworks in the U.S.A. An interim report had been issued, but the full report was expected to be published early in 1952.

Steady results over a long period had followed the investigations carried out by the British Iron and Steel Research Association, but it had also given immediate help in some of the difficulties due to scarcity of raw materials.

The serious shortage of sulphuric acid led to study of the possibility of making immediate savings. It was found that, in batch pickling of black-plate, about a quarter of the sulphuric acid was often being carried out unconsumed on the sheets leaving the pickling tanks, and this waste had now been substantially reduced by improved methods of draining and washing the sheets.

A more ambitious method of conserving sulphuric acid would be tested on a commercial scale during 1952, when a pilot plant would go into production for regeneration of the sulphuric acid from the waste pickle liquor.

Value of Fundamental Research

It was often difficult to indicate the practical value of fundamental research beyond saying that all applied research depended on it, but the association had now been in existence long enough for probable applications of some of its more academic work to be seen.

Study of the physical chemistry of steelmaking had the general aim of increasing knowledge of the processes and so of enabling their efficiency to be improved. One way in which this might be done was by reducing slag bulk. The importance of such a saving could be assessed by considering that a reduction of only one per cent in slag bulk could save the industry over £400,000 a year in fuel and materials alone.

Another fundamental research whose practical application was possible was that on the effects of alloying elements on the properties of pure iron.

Lactic Casein Licences

THE Ministry of Materials has announced that it has decided to dispose of the Government-owned stock of lactic casein. The decision to dispose of this stock has been taken because of the need to cut down imports from countries outside the sterling area.

Licences to import lactic casein from non-sterling areas will, in future, be granted conditionally upon the purchase of a proportion of the Government stock.

HOME

Sulphur from Petroleum

The first recovery of sulphur from petroleum on a commercial scale was begun by the Shell Petroleum Company, Ltd., at its refinery at Stanlow, Cheshire, last month. The sulphur thus made available will not only help to ease the supply situation but will also contribute to the U.K.'s effort to save dollars.

I.C.I. Buy Hotel

Crowborough's largest hotel, the Beacon, has been acquired by Imperial Chemical Industries, Ltd., possibly for residential use or for conferences. I.C.I. became owners on 25 March according to the *Kent & Sussex Courier*. The ground floor will remain open for local functions and bar facilities will not be affected, but the building will not be used as an hotel this season.

Employment Offered

University students wishing to supplement their academic training by practical experience of industrial and commercial conditions are offered employment with the Dunlop Rubber Co., for six or eight weeks during the Long Vacation. There are 100 vacancies, to be filled through appointments' officers at the universities, for men and women from the age of 18 upwards, at salaries ranging from £3 to £6 a week.

Refinery Strike Ended

Strikers at the Isle of Grain (Kent) site of the Anglo-Iranian Oil Company's £40,000,000 refinery resumed work on Friday, 28 March. The strike, involving 7,000 men, began on 17 March when 3,500 employees of McAlpine & Sons, the contractors, stopped work over a wage and bonus dispute. The other 3,500 men involved came out in sympathy.

River Derwent Pollution

Judgment for the plaintiffs, the Pride of Derby and Derbyshire Angling Association, Ltd., and the Earl of Harrington, was given by Mr. Justice Harman on 31 March in an action in which they claimed injunctions and damages for pollution of the River Derwent against British Celanese, Ltd., Derby Corporation and the British Electricity Authority (East Midlands Division). The case was adjourned for further argument as to the relief to which the plaintiffs were entitled.

Fertiliser Prices Reduced

Decreases in the price of phosphate rock by 15s. a ton, superphosphate by 11s. a ton, and of compound fertiliser by 12s. 9d. a ton as from 1 April were announced by the Ministry of Materials. Compounds containing ammonium phosphate were lowered by 14s. 6d. a ton. Reductions were stated to be mainly due to a decrease in the costs of sea freights and sulphuric acid.

Examination for Managers

The final examinations of the Institution of Works Managers will be held on Tuesday, 20 May, 1952. Those intending to take the examinations should communicate with the General Secretary immediately. The address is 67/8 Chandos Place, London, W.C.2.

Institution of Chemical Engineers

The 30th annual corporate meeting of the Institution of Chemical Engineers will be held at the May Fair Hotel, London, on Friday, 25 April. The business session will begin at 11 a.m. when the election of officers and members of council will be followed by the presentation of medals. At 12 p.m. the presidential address, 'Chemical Engineering at the Cross Roads,' will be delivered by Sir Harold Hartley. The annual dinner will be held at 7 p.m. in the ballroom. Applications from those wishing to attend should be received not later than first post on Monday, 14 April.

Reductions in H_2SO_4 Prices

The Minister of Materials has made an Order which came into effect on 1 April, 1952, reducing the maximum prices of sulphuric acid. The reductions (approximately 7 per cent on current prices) are in the main due to decreases in the freight rates on sulphur and pyrites. The price reductions are 5s. 10d. per ton of weak acid (77 per cent H_2SO_4) and 8s. 6d. per ton of strong acid (more than 84.02 per cent H_2SO_4). Copies of the Order, The Sulphuric Acid (Prices) (Amendment) Order 1952 (S.I. 1952, No. 647) is on sale at H.M. Stationery Office, price 2d.

OVERSEAS

Improved European Steel Output

Steel production in Europe in 1951 totalled 67,628,000 metric tons according to figures issued by the Economic Commission for Europe. This was an increase of 11.6 per cent on the output in 1950. The only decrease shown was the United Kingdom, the decline being largely due to lack of scrap. Output of the Soviet Union was not included but was estimated to have increased by some 4,000,000 tons, to a total of 31.300 000. Pig iron production in Europe in 1951 reached 49,200,000 tons, the highest total so far attained.

Radioactive Control

Strontium-90, by-product of the atomic energy plant at Oak Ridge, Tennessee, is now being used by B. F. Goodrich Tyre Company engineers to make the rubber coating of tyre fabrics smoother and longer-lasting. A radio-active beam from the strontium isotope determines the weight for each unit area of the fabric as it comes out of the rubber coating machine. Any variations are recorded at once, and the operator can make exact adjustments. Goodrich engineers say the device permits the control of rubber coating to within a millionth of an inch.

To Establish Rayon Plant

It is reliably reported that a new £3,000,000 rayon plant is to be built at Nathanya, in Israel. Capital will be supplied by American, Israeli and Japanese interests and most of the machinery will come from the International Machinery Corporation of Osaka.

Molybdenum and Tungsten

World allocations of molybdenum and tungsten for the first six months of the year were announced in Washington by the International Materials Conference on 29 March. A total of 8,200 metric tons of tungsten would be divided among 24 countries of which the U.K. would receive 1,629 metric tons of metal content distribution as ores and concentrates and 100 metric tons for export as primary products. Molybdenum allocations totalled 10,016 metric tons, to be split among 25 countries. The U.K. would receive 1,067 metric tons of metal content distribution as ores and concentrates and 67½ metric tons for export as primary products.

To Study Possibilities

A report has just been made to the French National Assembly urging the Government to examine, before the end of June, the practical measures necessary to set up a domestic synthetic rubber industry. The report states that the increase in the cost of importing rubber over the past two years would alone have more than paid for the cost of establishing the industry.

To Make Ductile Iron

Ductile iron will shortly be manufactured in Australia. The International Nickel Company, which controls production, has granted licences to some Australian manufacturers. Dr. Hans Pohl, a German technician who was brought to Australia by the Government to advise local industry, conducted research work into the iron when technical director of the Skoda works.

Oil Project Cancelled

A decision to stop prospecting for and drilling new oil wells in Egypt and to dismiss 200 workers has been made by the American Socony-Vacuum Oil Company according to a *Reuter* report. This action is said to be due to the delay by the Egyptian Government in amending the 1948 mining law, which imposed 'unworkable' conditions for oil prospecting.

Expert Reports

After completing a survey on behalf of the State Governments of Victoria and Queensland, Dr. A. A. J. K. Eskreiss, a director of Powell Duffryn Technical Services, Ltd., of London, said that Australia could produce oil from coal more cheaply than she could import refined motor spirit. He said that Australia had unlimited resources of coal suitable for the production of motor spirit. A £A30 000 000 plant at Blair Athol in Queensland would produce 300,000 tons of the fuel a year and this could be made for only 10d. a gallon.

First Catalytic Plant

A thermofor catalytic cracking unit, the first of its kind in Australia, is to be installed at the new £A13,000,000 refinery being built by the Vacuum Oil Company, Pty., Ltd., at Altona, Victoria.

PERSONAL

The Minister of Supply (Mr. Duncan Sandys) has announced that he has appointed MR. ROBERT MARSHALL to be a part-time member of the Iron and Steel Corporation. Mr. Marshall is a director of Colvilles Ltd., of Glasgow, and since 1 May, 1951, he has been loaned to the Corporation to advise them on sales and prices. Fifty-seven years of age, Mr. Marshall is also a director of British Basic Slag Ltd.

MR. SIDNEY ROGERSON, publicity and public relations controller, Imperial Chemical Industries, Ltd., is to be publicity adviser to the Army Council. He will be on loan for a period of from 18 months to two years and it is reported that his salary will be paid by the firm. Before joining I.C.I. in 1930, Mr. Rogerson was head of the publicity department of the Federation of British Industries.

The annual meeting of the West Riding section of the Society of Dyers and Colourists was held in Bradford on 27 March. The following officers were elected: *Chairman*, MR. S. L. PEEL; *vice-chairman*, MR. HAROLD FOSTER. DR. F. F. ELSWORTH was added to the committee, and MR. G. E. STYAN was re-elected secretary.

Glaxo Laboratories Ltd. announce that SIR HENRY TIZARD, G.C.B., F.R.S., has been elected a director of the company. Sir Henry recently retired as chairman of the Advisory Council on Scientific Policy and Defence Research Policy Committee.

MR. J. F. BYRNE, managing director, Paines & Byrne Ltd., Greenford, Middlesex, leaves England by the *Queen Elizabeth* on April 16 for a visit to the U.S.A. in support of the export drive. His firm are well-known manufacturers of gland, hormone and vitamin preparations. Mr. Byrne expects to return to England in the early part of June.

At the annual general meeting of the British Disinfectant Manufacturers' Association, held on 7 March, the following officers and executive committee were elected for the ensuing year: chairman, MR. A. ERNEST BERRY (Milton Antiseptic Limited); vice-chairman, SIR KNOWLES EDGE, Bart. (William Edge & Sons Ltd.); honorary treasurer, MR. VICTOR G. GIBBS (William Pearson Limited). Executive Committee: MR. A. J. BLACK (Lehn & Fink Products Ltd.); MR. P. J. BOVILL (Newton Chambers & Co., Ltd.); MR. J. H. CHAPMAN (Reckitt & Colman, Ltd.); MR. W. A. C. HALL (Prince Regent Tar Company, Ltd.); MR. W. M. MACMILLAN (Robert Young & Co., Ltd.); MR. W. MITCHELL (Hull Chemical Works, Ltd.); and MR. R. G. BERCHEM (ex officio) (Jeyes' Sanitary Compounds Co., Ltd.). The secretary is MR. W. A. WILLIAMS, M.B.E., B.Sc., 166 Piccadilly, London, W.1.

DR. A. J. TURNER, C.B.E., M.A., D.Sc., F.T.I., Director of Research of the Linen Industry Research Association, Lambeg, Lisburn, Northern Ireland, a former professor of textile technology at Manchester College of Technology, has accepted an invitation from the Council of the Textile Institute to be nominated as the Institute's next president. Dr. Turner has been a member of the Institute since 1919, and a vice-president since 1949. He was one of the first recipients of the Institute's Warner Medal (given in recognition of outstanding work in textile science and technology, the results of which have been published, and particularly for work published in the Institute's *Journal* in 1931).

Obituary

MORRIS W. KELLOGG, 79, founder and chairman of the M. W. Kellogg Company, has died at his home in New York. A graduate of Stevens Institute of Technology in 1894, Mr. Kellogg started the company in 1901 as a small pipe-fabricating shop in Jersey City. This led to pioneering in the fabrication of penstocks for the hydro-electric power industry and then to the manufacture of tanks for storing materials under high pressure and temperature. From this stemmed the firm's prominent position in the design and construction of petroleum refineries and chemical plants, for it eventually brought about the development of the first hammer-welded stills.

Publications & Announcements

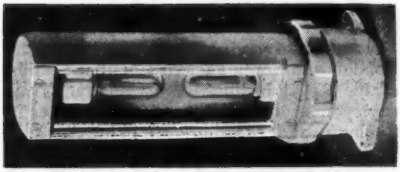
COPIES of a 144-page book 'Tensile and Hardness Properties of Carbon and Alloy Steel' are now available for free distribution from Heppenstall Company, 4620 Hatfield Street, Pittsburgh 1, Pa. The book contains much basic information concerning steel; the specific effects of various alloying elements in steel are discussed and there is a brief explanation of the manner of development of the tensile properties in a steel. Also included is a glossary of selected iron and steel terms and a number of helpful tables.

* * *

EXAMPLES of typical welded fabrications at present going through its shops are described and illustrated in its latest publication (R.1305), just issued by Davey, Paxman & Co., Ltd., Colchester. Since its establishment in 1865 the company has shown versatility and technical skill in undertaking the manufacture of a wide variety of engineering products. More recently a reputation has been established for its rotary vacuum filter, which although a highly specialised device, has a wide range of applications in the chemical, coal, food and allied industries. Among the examples given to illustrate the firm's varied work in connection with industrial processes is a causticiser of welded design which is an integral part of a plant for the production of caustic soda from tar distillation.

* * *

A WELCOME contribution to the science and art of industrial instrumentation is the first issue (April, 1952) of *Instrument Engineer*, to be published twice yearly by George Kent Ltd., Luton, Bedfordshire (subscription 5s.). The intention is to make available the latest information concerning advances in instrument technique; to encourage the proper recognition of the instrument engineer, and establish his status; to advocate the provision of proper educational facilities, with adequate courses of study and recognised awards; and to aim at the creation of more confident relations between the user and the maker. Subjects covered in this first number range from 'Oxygen Analysis' by R. S. Medlock, and 'Special-Purpose Applications of "On-Off" Control (Heat-treatment Furnaces', by E. E. Cook to a biography of Giovanni Battista Venturi.



THE vapour-tight gauge glass fitting for two 25 watt tubular lamps shown in the photograph was especially developed by the Metropolitan-Vickers Electrical Co., Ltd., for the new Esso refinery at Fawley, Southampton, and more than 600 are in use there. The units are generally used in groups of three or more, in line behind tubular glass gauges. The fitting consists of a silicon-aluminium conduit box to which is fixed a cast lamp housing with a recessed glass panel curved and lightly frosted on the inside. Approximately 3,000 Metrovick lighting units of various kinds are installed throughout the Fawley plant.

* * *

DEVELOPMENTS in steel shell water cooling units which may be installed in or out of doors and have a wide range of applications are described in its latest brochure (Publication No. 514), by the Visco Engineering Co., Ltd., Croydon. There are a number of new illustrations and the text has been slightly revised. Reference is also made to the Visco 'Sprayblast' oil cooler, claimed to be the first oil cooler to use a mixture of air and water as the cooling medium.

* * *

A NEW primer, known as ALC, for the protection of metal surfaces, has been produced by Detel Products Ltd., South Ruislip, Middlesex, pioneers of chlorinated rubber coatings. The new primer is not effective by itself, but requires a Detel top coat, Grade 'A' being preferable for general use, which should be applied within 24 hours before exposure to the weather. Tests, it is claimed, show that no deterioration has occurred to ferrous metal surfaces coated with these materials after 12 months of salt spray. ALC is also said to be useful in acid and alkaline conditions, while it is also effective where the paint system is exposed to hot caustic soda solutions and will withstand temperatures up to 200°F.

Next Week's Events

MONDAY, 7 APRIL

Society of Chemical Industry

London: University College, Gower Street, W.C.1. Joint meeting with the London and South-Eastern Counties Section of the Royal Institute of Chemistry. Two-day symposium on 'Electrolytic Processes in Chemical and Metallurgical Industry.'

Institute of Packaging

Manchester: Grand Hotel, 6.30 p.m. E. D. S. Baker and J. L. Winfield: 'Engineering and Packaging—the Fundamentals of Package Design and Mechanisation.'

TUESDAY, 8 APRIL

Chemical Engineering Group (SCI)

London: Burlington House, Piccadilly, W.1., 5.30 p.m. A. G. Monroe, H. A. S. Bristow and J. E. Newell: 'Heat Transfer to Boiling Liquids at Low Temperatures and Elevated Pressures.'

Society of Public Analysts

London: Burlington House, Piccadilly, W.1, 6.30 p.m. 36th ordinary general meeting of the Physical Methods Group, meeting organised by the Polarographic Discussion Panel.

Incorporated Plant Engineers

Manchester: Engineers' Club, Albert Square, 7.15 p.m. R. F. W. Guy and J. P. Lauder: 'Mechanical Stokers and Coal Handling Plant.'

Edinburgh: 25 Charlotte Square, 7 p.m. D. T. McHutchison (Vacuum Oil Company): 'The Development of Modern Lubricating Oils,' and film 'The Inside Story.'

Society of Instrument Technology

Manchester: College of Technology, 7.30 p.m. Dr. M. O. Pelton: 'The Design and Manufacture of Optical Instruments.'

WEDNESDAY, 9 APRIL

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Food Group, 21st annual general meeting, followed by an address by Professor Ancel B. Keys (Professor of Physiological Hygiene, University of Minnesota): 'Health and Diet in the Western World.'

London: Brown's Hotel, Albemarle Street, W.1, 8 p.m. Microbiology Group. Informal dinner.

THURSDAY, 10 APRIL

Incorporated Plant Engineers

Maidstone: Queen's Head Hotel, 7 p.m. 'Toughened Glass,' demonstration and films.

Newcastle-upon-Tyne: Roadway House, Oxford Street, 7.30 p.m. D. V. Rowles (Fielding and Platt, Ltd.): 'Applications of Hydraulics.'

FRIDAY, 11 APRIL

The Chemical Society

St. Andrews: United College, 5.15 p.m., with the St. Andrews University Chemical Society. Dr. W. A. Waters: 'Mechanism of Oxidation of Organic Compounds.'

Textile Institute

Cardiff: University, Cathays Park, 7.15 p.m. J. M. Preston: 'Studies in the Structure of Fibres.'

Oil and Colour Chemists' Association

Manchester: Grand Hotel, 6.30 p.m. Manchester Section, annual general meeting.

DSIR Information Service

THE DSIR Headquarters Technical Information Service has been merged with the Technical Information and Documents Unit, it is announced. The new unit retains the name TIDU. Its address is Cunard Building, 15 Regent Street, S.W.1 (Tel.: WHItehall 9788). The unit holds the German industrial documents which were brought back to this country after the war. It is receiving unpublished reports from British and American sources and from which it issues summaries. Many of these reports contain information which is not published in the normal way.

TIDU maintains a technical inquiry service and is the British centre for an international questions-and-answers scheme. This scheme is organised to provide information about industrial techniques from the U.S.A., Canada, France, Germany, Ireland, Sweden and the U.K. It is hoped that the scheme will help to cut out unnecessary delay and expense in the development of production processes.

TIDU has a reading room on the 3rd floor of Cunard Building. This is open during normal office hours on weekdays and Saturday mornings.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Increases of Capital

The following increases of capital have been announced: BOOTS CASH CHEMISTS (SOUTHERN) LTD., from £900,000 to £1,150,000; BOOTS CASH CHEMISTS (LANCASHIRE) LTD., from £450,000 to £700,000, BOOTS CASH CHEMISTS (WESTERN), LTD., from £630,000 to £880,000; BOOTS CASH CHEMISTS (NORTHERN), LTD., from £475,000 to £725,000.

New Registration

Bulstrode Technical Services, Ltd.

Private company. (505,749). Capital £100. To carry out and enter into contracts for research, consulting and commercial development work in the chemical, fuel and allied industries, etc. Directors: Sir John F. Ramsden, Bt., Major C. L. Walsh, Dr. W. Francis. Reg. office: 16 Gt. College Street, Westminster, S.W.1.

Company News

Anchor Chemical Co., Ltd.

Net trading profit of the Anchor Chemical Co., Ltd., for the year ended 30 November, 1951, was £66,329 (£50,860). In his address to shareholders at the 45th annual general meeting held at Clayton, Manchester, on 21 March, Mr. T. H. Hewlett, chairman, said that to cover future contingencies the building and research reserve should be renamed general reserve with a total of £90,000. Overseas sales reached a record figure. The research laboratories had continued their active search for new ideas and with its entry into the lubrication industry the company had considerable interest in extreme pressure additives and other materials used in lubrication. A final dividend of 20 per cent on ordinary shares, was recommended, making a total of 27½ per cent for the year.

The Steetley Company, Ltd.

A comprehensive survey of specialised work in the production of dolomite and refractories necessary for all industrial and domestic processes involving the application of heat was given by Mr. N. M. Peech, chairman and managing director of the Steetley Company at its 22nd annual general meeting held in Sheffield on 31 March. Expenditure on new machinery, buildings, etc., in the last five years amounted to £1,264,365. Group trading surplus totalled £599,627 of which 27 per cent was allocated to reserves, 58 per cent for taxation, and 15 per cent to dividends.

Market Reports

LONDON.—Conditions in the industrial chemicals market show little change on the week, and with the exception of the textile trades, inquiries for new business have been satisfactory. Prices throughout the market are steady.

Among the soda products, there is a persistent call for supplies of caustic soda, bicarbonate of soda and soda ash, while most of the potash chemicals are on a strong basis.

The movement in the coal tar products market is largely taken up with contract deliveries and strictly new business has been on a moderate scale. Carbolic acid crystals and creosote oil continue in steady request.

MANCHESTER.—Replacement buying on the Manchester market for heavy chemical products during the past week has been on a fair scale, though there has been a noticeable decline in the pressure for deliveries of textile bleaching, dyeing and finishing chemicals. The demand for these products is not likely to show any recovery until signs of improvement in the cotton and rayon industries make their appearance. In the meantime, a reasonably steady movement of supplies has been reported this week on export account. There is a fair call for fertiliser materials, including the phosphatics, and deliveries of most of the tar products against contracts have been about maintained.

GLASGOW.—Due to lack of demand from the textile trade, supplies of numerous products are much more readily available. Trade on the whole has been steady but quiet and little change is expected in the near future. There have been some very interesting orders fulfilled for the export market but whether or not interest will be maintained remains to be seen.

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CLASSIFIED ADVERTISEMENTS

EDUCATIONAL

THE INSTITUTION OF CHEMICAL ENGINEERS' 28th ASSOCIATE MEMBERSHIP EXAMINATION

APPLICATION forms (returnable June 2nd, 1952) and particulars of the 28th Associate Membership Examination, may be obtained from Hon. Registrar, **INSTITUTION OF CHEMICAL ENGINEERS, 56, VICTORIA STREET, LONDON, S.W.1.**

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive, or a woman aged* 18-59 *inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

CHEMICAL ENGINEER, with experience of the design and operation of modern plant, is required by a long-established and live Firm of Chemical Manufacturers. Duties will be in the Chemical Engineering Department of the Company, and will cover both development of existing processes and the design of new plant, from pilot plant stage to final commissioning. Apply, in confidence, to **BOX No. C.A. 3133, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

PROJECT ENGINEER (25-35) required for By-product and General Chemical work. Salary £600 minimum. Permanent position. Pension Scheme. Canteen. Apply **CHEMICAL ENGINEERING WILTONS, LTD.,** Holbrook Park, Horsham, Sussex.

REQUIRED for progressive Company, man about 25-35, with selling experience and knowledge of Metallurgy and Chemistry. Interesting position with prospects, good remuneration. Applications, with full curriculum, to **BOX No. C.A. 3129, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

TWO ASSISTANT ENGINEERS (25-35) with experience of design and erection of Gas Works By-product and Tar Distillation Plants, required by **CHEMICAL PLANT ENGINEERS** in Horsham area. Salary, £500-£700, according to experience. Permanent position. Pension Scheme. Canteen. Apply **CHEMICAL ENGINEERING WILTONS, LTD., HOLBROOK PARK, HORSHAM, SUSSEX.**

YOUNG LADY, aged approximately 22-30 years, required for the Chemical Laboratory of a large Electrical Engineering Company in the West London area. Applicants should have studied Chemistry up to H.S.C. or Inter.B.Sc. standard and should be experienced in Chemical Analysis. Five-day week, good conditions and pay. Write, giving details of age and previous experience, to **BOX No. C.A. 3131, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

SITUATION VACANT

YOUNG LADY, aged approximately 25-35 years required for experimental testing work on electrical domestic laundry equipment manufactured by a large Engineering Company with laboratories in the West London area. Applicants should have a good general education, previous laboratory experience, and be prepared to carry out tests which are of a practical nature. Interesting and varied work. Good conditions and pay. Write, giving details of age and previous experience, to **BOX No. C.A. 3130, THE CHEMICAL AGE,** 154, Fleet Street, London, E.C.4.

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PROCESS PLANT

Two Steam-jacketed **ROTARY VACUUM DRYERS,** each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S. J. chamber.

Gas-fired **OVEN** by Bertram Thomas. Internal dimensions, 3 ft. wide by 3 ft. 3 in. high by 2 ft. 6 in., with removable framework for trays. Two burners fitted governor and Spersom regulator. Double swing doors.

Selas Type 9 **GAS AND AIR MIXING MACHINE,** comprising gas inlet governor, air and gas proportioning valve with Vernier adjustment, back pressure valve, booster unit, and delivery pressure controller. Maximum capacity, 25,000 cu. ft. per hr. Air/Gas mixture at adjustable delivery pressure.

Carton Filling, Packing, Wrapping and Labelling **MACHINE** by **SOCIETE INDUSTRIELLE SUISSE,** adjustable for cartons from 73 mm. sq. by 38 mm. to 65.6 mm. sq. by 38 mm. Motorized 400/3/50. Complete with label attachments and heat sealing device. Conveyor feed approximately 55 per min.

De-Airing Type **PUG MILL** by Bonnot Primary Chamber 4 in. diam., secondary worm extruder, 3 in. diam., 3 in. discharge with 7½ in. by 9 in. opening. Of aluminium construction with stainless steel shaft and worms. Motorised 220/440/3/50.

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Tel.: Pudsey 2241.

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CROSS-TUBE, 8½ ft. by 3½ ft., 7 ft. by 3 ft., 6 ft. by 2 ft. 6 in., all 80 lb. pressure. C.I. Jacketed Copper-lined **STEAMING PAN,** 25 gallons, on three legs. "Worthington" 4 in. Motorised Centrifugal **PUMPS,** 90 g.p.m., 400 /3/50.

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FOR sale approximately 3 tons of **PETHALIC ANHYDRIDE** of standard quality at 3s. 5d. per lb. **BOX No. C.A. 3132, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.**

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"GARDNER" Heavy Duty "U" **TROUGH MIXER** 5 ft. 6 in. by 2 ft. 4 in. by 2 ft. Jacketed Autoclave with aluminium inner pan 8 in. diam. by 24 in. deep—aluminium mixing blades. Twin "Z" **BLADE TIPPING MIXERS,** 43 in. by 40 in. by 28 in., 16 in. by 16 in. by 14 in., also lab. sizes. Rectangular R. **STEEL TANKS** up to 10,000 galls. capacity. Film dryers or cooling rolls—9 ft. by 4 ft. diam. Disintegrators—24 in., 22 in., 18 in., and 12 in. diam. chambers. Two—W.S. Cyl. Enc. **TANKS**—12 ft. 6 in. by 9 ft. deep—6750 galls. **CONDENSERS, PUMPS, HYDROS, STEAM ENGINES, ETC.**

HARRY H. GARDAM & CO., LTD., STAINES

GRAVITY Roller Conveyor several lengths, Rolls. 2¼ in. diam. by 16 in. 3 in. centres. Good condition. **THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET MILLWALL E.14.** (Tel. East 1844.)

NEW **FILTER PRESSES, HYDRO EXTRACTORS** and **BALL MILLS** for early delivery. Prices and details on application to **DONALD LEAVER, LTD., 165, RAILWAY ARCHES, STAMFORD BROOK STATION LONDON W.6** (Riverside 1880).

NEW AND UNUSED PLANT
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STAINLESS STEEL REACTION TOWER, 3 ft. 6 in. diam. by 24 ft., in three sections. £1,050.

33—Aluminium-tubed **CONDENSERS,** 140—⅝ in. O.D. tubes, 9 ft. 10 in. long. £250.

1—Aluminium-tubed **CONDENSER,** 271—¾ in. O.D. tubes, 16 ft. 6 in. long. £750.

6—Copper-tubed **CONDENSERS,** 300—¾ in. O.D. tubes, 8 ft. long. £350.

4—**CONDENSERS,** 228—½ in. bore brass-lined steel tubes, 4 ft. 8 in. long. £165.

1—550-gallon Enclosed Stainless Steel **OVAL TANK,** polished internally.

4—2-in. Stainless Steel **CENTRIFUGAL PUMPS.** £80.

3—4-in. Pulsometer Stainless Steel **CENTRIFUGAL PUMPS,** direct coupled to 3 h.p. A.C. motors. 250 g.p.m. at 17 ft. head. £165.

1—1½-in. Pulsometer Stainless Steel **Submerged CENTRIFUGAL PUMP,** 3 h.p. A.C. motor. 50 g.p.m.at 68 ft. head. £120.

1—1½-in. Pulsometer Regulus Metal **CENTRIFUGAL PUMP,** direct coupled to 3 h.p. A.C. motor. 25 g.p.m. at 83 ft. head. £100.

2—Scott **STILLS,** horizontal welded steel, 8 ft. 6 in. diam. by 20 ft. long, 56—2-in. steel tubes.

1—Scott Forced Circulation **EVAPORATOR,** containing 820 2 in. by 6 ft. copper tubes.

3—2000-litre Enlosed **EARTHENWARE JARS,** acid-resisting glaze.

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SCREENLESS PULVERIZERS for fine grinding of Chemicals. Also **CYCLONES, ROTARY VALVE FEEDERS. Callow (Engrs.) Ltd. Kirkby Trading Est. Liverpool.**

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Four Stainless CONICAL HOPPERS, 1200 gallons, 8ft. 3 in. diam. overall depth 7 ft. 6 in.

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